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STUDY OF A WIND ENERGY CONVERSION SYSTEM IN NEW HAMPSHIRE. (U)

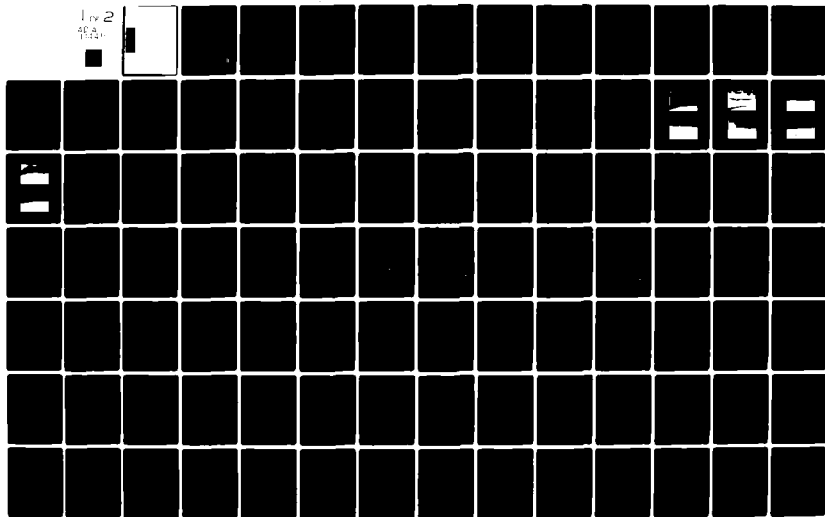
AUG 81 J LOCKWOOD, G KRAFT, G PREGENT

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STUDY OF A WIND ENERGY CONVERSION
SYSTEM IN NEW HAMPSHIRE

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August 1981

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under Contract No. N00014-79-C-0725

University of New Hampshire
Durham, New Hampshire

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FOREWORD

The University of New Hampshire has prepared this report for the Office of Naval Research under Contract No. N00014-79-C-0725.

Work described herein was performed by three institutions. The University of New Hampshire was in charge of project management and wind data analysis. The Energy Law Institute of the Franklin Pierce Law Center investigated and reported on legal-institutional issues relating to wind energy in New Hampshire, and the Mount Washington Observatory was responsible for the installation and maintenance of field equipment.

In order to receive feedback from the public and private sectors regarding wind energy applications in New Hampshire, a Wind Energy Advisory Committee (WEAC) was formed. The WEAC consisted of representatives from private industries, utilities, and state and federal institutions. Meetings and correspondence provided the means of communication during the project.

The authors wish to thank all those who contributed to this project. In particular, thanks are due to the members of the WEAC, the land-owners who gave permission to allow wind data to be collected on their properties, personnel of the New Hampshire Department of Resources and Economic Development, personnel of the White Mountain National Forest, and leasees of National Forest land.

The authors also wish to thank Peter Hodgkins, John Nettleton, Wayne Sanborn and Mohammed Rachedine of the University of New Hampshire for their technical support in preparing the data summaries, and Jonne Adler for her consistently excellent editorial and typing help.



CHAPTER 1. INTRODUCTION

Concern over conventional energy costs and supplies is currently strong, particularly in the New England region where eighty percent of the total energy is oil based; furthermore, forty percent of this region's total energy is OPEC oil. These figures contrast with national averages of forty-seven and thirteen percent, respectively (1). The quest to develop alternative and renewable energy sources indigenous to New England is understandable in light of these figures. The wind is one such source.

The study of wind energy can be divided into three basic areas; these are technical, legal-institutional, and financial. The technical area encompasses collection and analysis of wind data, selection and installation of wind turbines and peripheral equipment, and operation and maintenance. The legal-institutional area encompasses the resolution of such issues as land use policies, power contracts, and state and federal regulations. The financial area encompasses the examination of investment opportunities made available by various site-machine combinations and the selling of such opportunities to the investment community.

Two of the three problem areas of wind energy are discussed in this report with the state of New Hampshire as the focal point. Specifically, the collection and analysis of wind data and the identification and analysis of legal-institutional issues are pursued.

Throughout this report, it is implied that large-scale (>100 kw) wind systems including wind farms are being considered. Small-scale or residential-scale systems are not expected to have much of an impact on conventional energy sources. The reason for this is that the concentration of homeowners is in southern New Hampshire where average wind speeds are known to be low, or in river valleys and other protected areas. In New Hampshire, it is the exception to find a residence associated with energetic winds. Sites that are windy are generally located in rugged terrain, and development of such sites is favored by the economies of scale provided by large wind systems.

Each of chapters 2 through 5 begins with introductory remarks followed by sections which elaborate on the theme of the chapter. Chapter 2 discusses the historical background of the current study, the methodology adopted for the study, and historical wind data sets. Various topographic features of New Hampshire relevant to wind energy development are discussed in Chapter 3. The selection of the field sites for wind monitoring, equipment used, and reflections on the field experience are discussed in Chapter 4. Chapter 5 provides an analysis of the data. Legal-institutional issues are identified and examined in Chapter 6.

CHAPTER 2. BACKGROUND

2.1 INTRODUCTION

The state of New Hampshire, with its mountainous terrain and its location within the tracks of migrating cyclones and anticyclones which are characteristic of the mid-latitude westerlies, offers the potential to reduce dependence on oil through wind energy development. High utility costs, an available wind resource and, as will be discussed later in Chapter 6, regulatory controls favorable to alternative energy producers, are three factors which seem to confirm this potential.

Although interest in developing local wind energy resources can be traced back forty years to the Smith-Putnam project (2), recent attraction to this region has been motivated by Department of Energy mission analyses (3,4,5). The purpose of these was to estimate the potential for wind energy development on a national scale and to identify specific areas of high potential. In these three analyses and in a synthesis of the three (6), New England and particularly the mountainous sections of New Hampshire were assigned some of the highest wind power densities in the country. These national analyses are being refined by attempts to produce regional analyses which concentrate on various sectors of the United States. Topographic features and existing meteorological data serve as input; maps showing estimates of mean wind power densities for each region are the resulting product. The northeast regional analysis has recently been published (7), and a comparison of the estimated power densities with power densities derived from actual wind observations on mountain-top locations will be made in Chapter 5.

2.2 STUDY CONCEPT

It was the reputed wind resource in New Hampshire which prompted the Department of Navy to consider the possibility of easing the energy costs of the Portsmouth Naval Shipyard through assistance from wind-generated electricity. This electricity was to be wheeled to the Shipyard over existing transmission grid lines from the windy mountainous sections of the state where wind turbines were to be eventually located.

Commitment to the concept of assisting the energy demands of the Portsmouth Naval Shipyard with wind-generated electricity came in the form of a specific federal budget appropriation. The University of New Hampshire was selected to undertake a year-and-a-half study. Commencing in July of 1979 this study was to concentrate on two problem areas: collection and analysis of site-specific wind data and examination of legal-institutional issues. Since preliminary examinations of the overall concept were needed, the Department of Navy commissioned three feasibility studies to be completed during the fall of 1979 (8,9,10). These three studies were to provide some guidance for the longer-term University study, but they were to serve principally the role of proof-of-concept.

In substance, the three studies all agreed that a reasonable wind energy resource existed in New Hampshire. Two of the studies (8,9) concluded that the Naval Shipyard would not benefit from the wheeling in of wind generated electricity; co-generation and an inadequate line supplying utility power to the Shipyard were cited as the reasons. The third study (7) concentrated on assessing the resource and did not consider the practicality of bringing wind-generated electricity to the yard. With an appropriation and a contract for the University study already formalized, work proceeded. Instead of the Shipyard being the direct beneficiary of the study results, it was then perceived that the public and private sectors would receive the benefit of the knowledge gained. It is hoped that this knowledge will accelerate the penetration of wind energy into the supply of commercial power.

2.3 METHODOLOGY

The feasibility and economy of a wind turbine project depend on proper siting. There are two major reasons for this. First, turbine performance is controlled by the precise location of the installation. In complex terrain, the effect of topography on airflow is great, and careful site selection to maximize performance is important. Second, legal-institutional issues, although usually not a function of precise location, must be clearly resolved before commitments to develop are made. These issues can vary greatly between townships and within townships. In addition to the problems of siting to maximize performance and of

legal-institutional issues, other factors, such as proximity to existing power lines and site development costs also influence economy and feasibility.

The importance of siting to wind energy applications has dictated the methodology adopted in this project. With the University of New Hampshire serving as the prime contractor, the study was divided into three parts: technical issues, legal-institutional issues, and field operations. An empirical approach was necessary; site-specific observations of wind and site-specific identification and analysis of legal institutional issues were planned. In addition to project management, the University was responsible for technical issues, including the analysis of wind observations. The responsibility for legal-institutional issues was assigned to the Energy Law Institute of the Franklin Pierce Law Center. The Mount Washington Observatory was in charge of field operations which included the installation and operation of wind monitoring equipment.

Because of the public impact of wind energy development, a method of outreach was established to keep various public and private groups informed of the progress of the study and of general issues relating to wind energy applications in New Hampshire. The outreach was established in the form of the Wind Energy Advisory Committee composed of representatives from utilities, conservation groups, private industry, and state and federal agencies.

2.4 HISTORICAL DATA SETS

There is a meager supply of historical wind data sets for New Hampshire. The only principal sources of long-term wind data in this state are the National Weather Service Office in Concord, Pease AFB in Newington, and the Mount Washington Observatory in Gorham. Except for the Observatory location which has an annual average wind speed of 35 mph, the other data sources are airports having very low wind speed averages. There have been other sources of wind data, but records have been short and documentation of equipment and of observation practices is not available.

Figure 2.1 shows monthly average wind speeds for the Concord, Pease AFB, and Observatory locations. The Observatory site can be considered to represent

the high extreme and the other two sites might represent the low extreme. The hope of locating practical locations between these extremes is the fundamental basis of interest in New Hampshire's wind energy resource.

Discussion of historical wind data sets and of wind energy applications in New Hampshire would not be complete without reference to the omnipresent Smith-Putnam project of the 1940s (2). This project has so pervaded the literature that there is no need to discuss it in this report. Suffice it to say that the investigators in the current study have been aware of the techniques applied in the project.

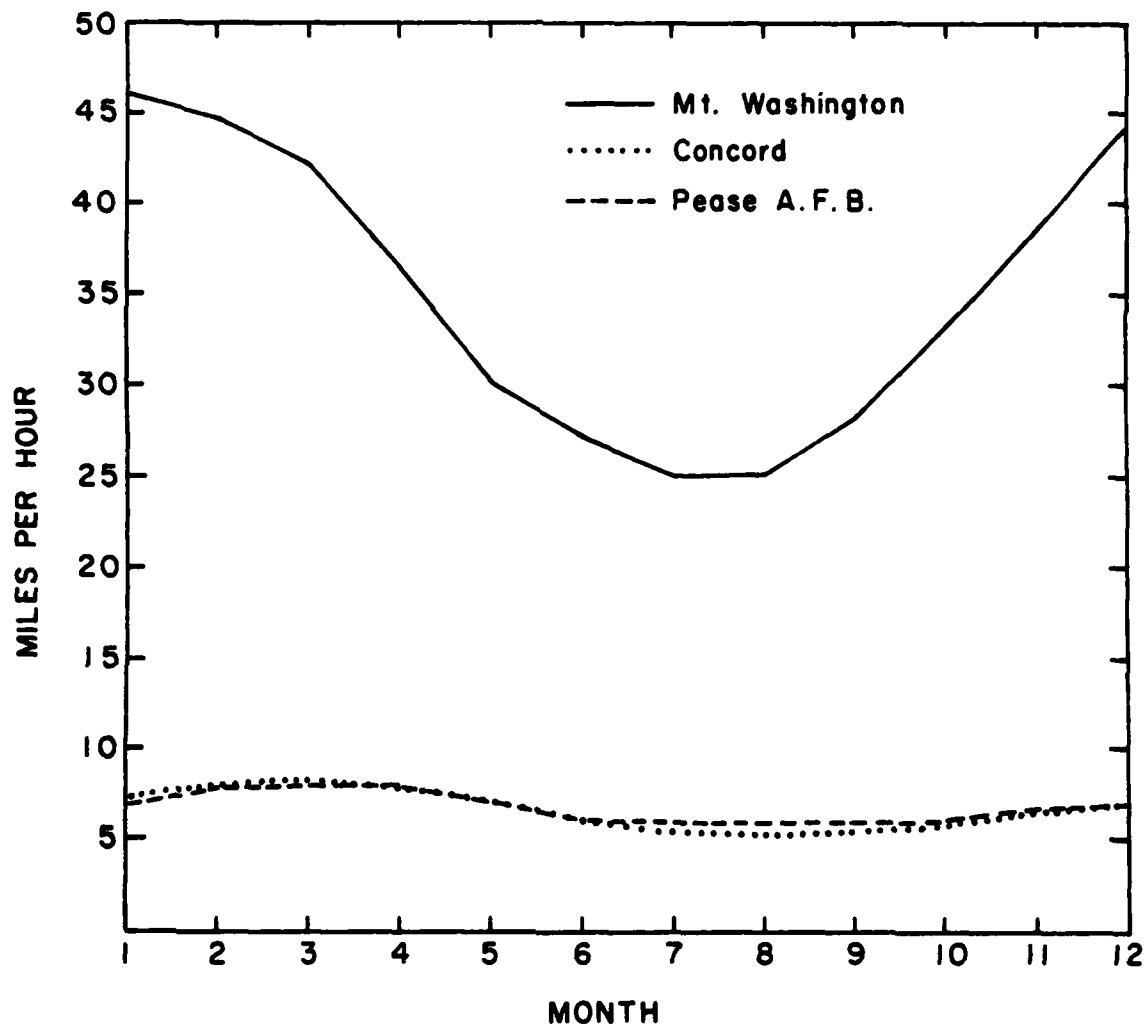


Figure 2.1 Monthly average wind speeds for Concord(1941-70), Pease AFB(1956-71) and Mount Washington(1941-70).

CHAPTER 3. TOPOGRAPHY

3.1 INTRODUCTION

New Hampshire's reported high wind power densities (3,4,5,6) exist by virtue of its mountainous terrain. Examination of the topography in conjunction with available data sets (11) draws one to make two conclusions. First, large-scale wind energy sites in this state will generally consist of mountain peaks and ridges in the elevation range of 2000'-4000' above sea level; broad expansive plains having high wind speed averages simply do not exist. Second, although wind power densities may be high, the areal extent of individual peaks and ridges is not great; this precludes the development of the sizeable operations now contemplated for Hawaii (12) and for some western states (13).

There are many peaks and ridges in New Hampshire which are appropriate for wind energy development. Wind statistics, legal issues, and site development costs will determine which sites are developed first. Knowledge of topography, with its influence over wind power densities, will aid a developer in focusing his attention when he is prospecting for sites. Subsequent examination of legal issues and development costs will determine which specific sites justify later stages of collecting on-site wind data and construction of wind turbine generator systems.

Although for the most part wind energy can be treated as a purely objective problem, there are some intangible aspects which must be appreciated. In New Hampshire, elevation and exposure explain much of the variance in known and estimated wind speed averages. Elevation and exposure also explain the popularity of the state with tourists and residents who seek a wilderness experience or scenic vistas of undeveloped mountains. Hence topography has provided this state with wind energy and with a scenic landscape. Whether these two attributes are compatible depends both on local reactions, and on the reaction of the public at large if state or federal land is involved.

This chapter discusses some of the major topographic features in New Hampshire as these features relate to suspected high wind speeds. Although the discussion is general and not exhaustive, it does serve as a guide to a developer who is in the early stages of prospecting. Section 3.2 provides a brief summary of the geologic origin of the current New Hampshire topography, and the remaining sections discuss specific features which are depicted in Figure 3.1.

The information about topography presented in this chapter was an aid in the selection of sites for the wind monitoring effort discussed in Chapter 4.

3.2 GEOLOGIC ORIGIN

For purpose of this report only a brief discussion of geologic origin is appropriate. Metamorphosis and folding of sediments once underlying a shallow sea and intrusions of magma into and occasionally through the sedimentary rock have provided the various rock types found in New Hampshire. Differential erosion of weather-resistant and non-resistant rock established the pattern of major valleys and mountains. The valleys and mountains were subsequently modified by glaciation. Erosion is the dominant process today. This sequence of events has resulted in exposed bedrock or bedrock within a foot of the surface of most mountain peaks and ridges. The developer must consider this bedrock when construction is planned or when stations are established to collect wind data.

3.3 WHITE MOUNTAIN MAGMA SERIES

One of the most prominent topographic features relevant to wind energy is this White Mountain Magma Series consisting of the Pawtuckaway, Belknap, Ossipee and Presidential mountain ranges. These ranges are examples of the intruding magma described in Section 3.2. Elevations above sea level in the series range from 1000 feet in the Pawtuckaways to 2300 feet in the Ossipees and Belknaps to over 6000 feet in the Presidentials. The Pawtuckaways, probably because of their low elevations, are not known locally for high wind speed averages. The Presidentials, the Belknaps, and the Ossipees, in descending order, are thought to represent higher averages, but only the latter two show promise of development because of legal-institutional issues (see Chapter 6).

3.4 WAPACK MOUNTAIN RANGE

This basically north-south trending range in south central New Hampshire and its extensions, including Crotched Mountain, rises from less than 1000 feet above sea level in the south to over 2000 feet in the central and northern sections. Many of the peaks in the range can be described as "monadnocks" or lone peaks rising above a peneplain. For this reason, exposures for wind turbines are quite good and wind speed averages are locally considered to be high.

West of the Wapack range is Mount Monadnock from which the term "monadnock" was derived. This peak rises to over 3000 feet above sea level and is a very popular scenic recreation area.

3.5 CONNECTICUT VALLEY

This river valley forming the boundary between New Hampshire and Vermont has on its eastward flank a number of ridges and peaks which, because of their elevation and exposure, appear to be good prospects for wind energy applications. Croydon Mountain (2700'asl) and Grantham Mountain (2600'asl), both located northeast of Claremont in Sullivan County, are good examples. Dalton Mountain, Stratford Mountain, and Percy Peaks in Coos County are other examples.

3.6 COOS COUNTY

Coos County in northern New Hampshire has two features attractive to wind energy developers. First, there are many sites with high elevations and good exposures. Second, much of the county is under private ownership, a feature which is beneficial from a legal-institutional perspective. A disadvantage of this section of the state is its remoteness; existing power lines are not common and access is often difficult.

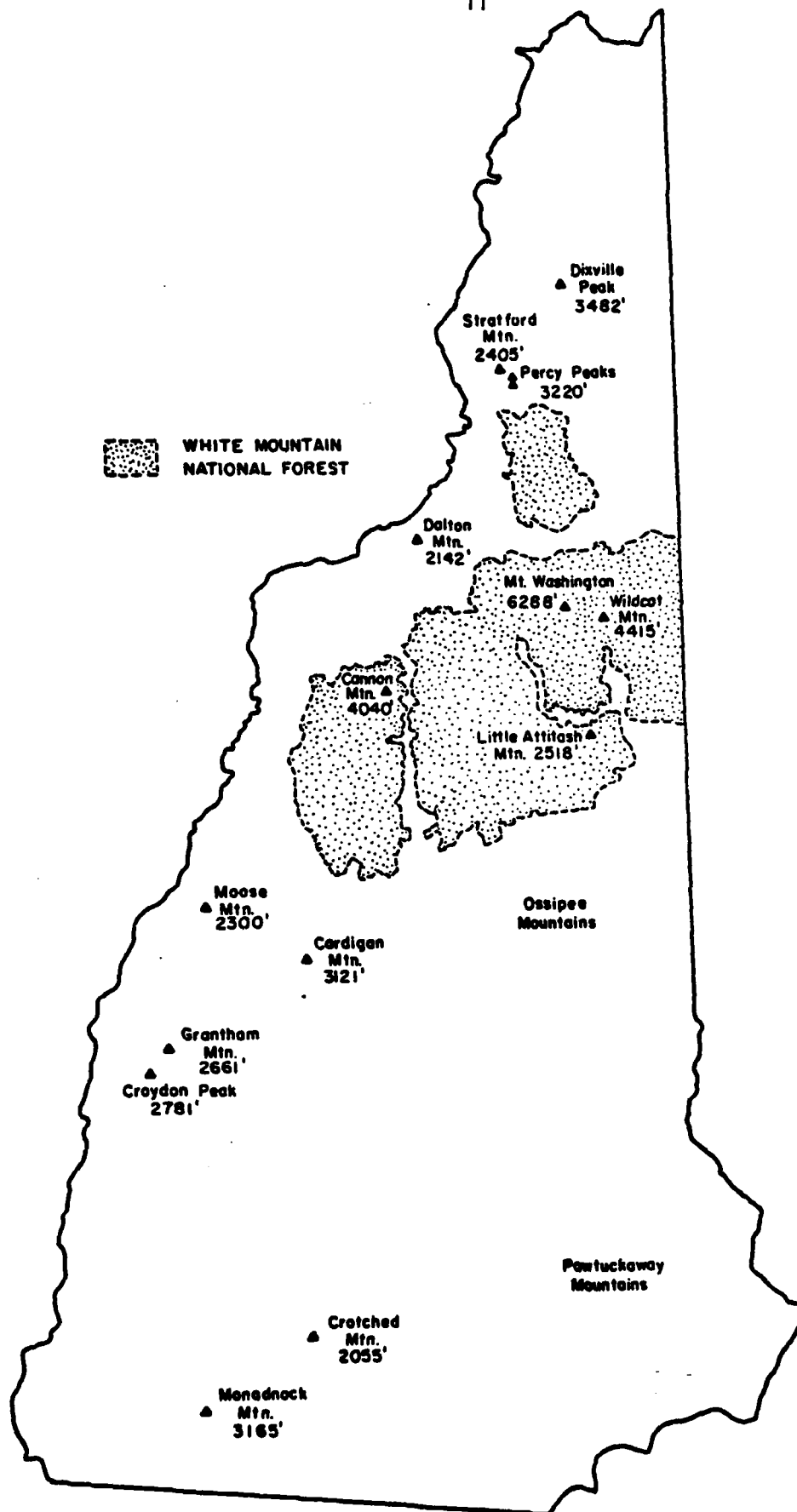


Figure 3.1 Several topographic features of New Hampshire

CHAPTER 4. FIELD OPERATIONS

4.1 INTRODUCTION

Conventional wind data sets associated with commercial airports, Air Force bases and Coast Guard stations did not satisfy the site-specific needs of wind energy prospecting in the complex terrain of New Hampshire. In the current study, a field program was established to install and maintain wind monitoring equipment at a variety of mountain sites suspected of having energetic winds.

The field program, which began in the summer of 1979 and lasted until the spring of 1981, consisted of several parts: selection of sites for monitoring, selection and installation of equipment, and the operation of equipment.

This chapter discusses the several parts of the field program and also provides recommendations based on the experience. The project relied mostly on off-the-shelf data collection equipment. The characteristics of the equipment are discussed in terms of performance, and the comments provided are intended to assist others who are contemplating wind prospecting programs.

It should be emphasized that this field program was a "prospecting" effort. That is, the general purpose was to locate sites having wind speed averages acceptable for energy development. If windfarms, or clusters of machines, are contemplated for any of the sites monitored by this project, developers must analyze the sites carefully for the placement of individual machines. Such analyses might require additional wind monitoring, especially if sites have complex terrain and if downwind effects of one turbine on another are an important concern.

4.2 SELECTION OF SITES FOR MONITORING

During the summer of 1979, topography and qualitative knowledge of local winds served as guidance in screening the state for a collection of prospective monitoring sites. Actual inspection of sites and meetings with landowners and leaseholders ensued.

The project budget allowed for the selection of eight sites (see Table 4.1 and Figures 4.1-4.8). Criteria for final selection included accessibility,

proximity to existing power lines, landowner cooperation and representativeness of sites to particular topographic features. The continuum of favorable and unfavorable traits presented by each site required compromises in the selection process which involved the screening of fifty sites. Each of these sites was visited and rated according to its merits. Notice in Figure 3.1 that the eight sites listed in Table 4.1 are distributed throughout the state and approximately represent the elevation range of 2000-4500 feet above sea level. The sites also represent both public and private ownership.

Attempts by developers to commercialize wind energy in New Hampshire will begin at those sites that are most easily and inexpensively exploited; as experience is gained and as utility costs rise, those parameters which now prohibit development of certain sites will become less important. This is also to say that sites now scoring high in several respects should not be summarily rejected from current development plans for failing to meet one or two other criteria. Much has been said, for example, about a need to avoid sites in the White Mountain National Forest or in state parks because of the difficulty of obtaining permits; yet a 40 kw machine on Little Attitash Mountain may be installed within White Mountain National Forest boundaries during the spring of 1981 as part of the DOE Appropriate Technology Program.

4.3 SELECTION AND INSTALLATION OF EQUIPMENT

A. TOWERS

Of the eight sites chosen for monitoring, four sites required the installation of towers to deploy the wind sensors. At three of the remaining four sites, special brackets to support the sensors were attached to fire observation towers, and at the last site, special brackets were attached to a TV broadcast tower. In all cases, the wind sensors were exposed at approximately ten meters above the local prevailing ground cover. That is, if trees were present at a site, the sensors were installed ten meters above the trees. At the site of the TV broadcast tower (Moose Mtn.), a second set of sensors was deployed at 200 feet above ground level.

For those four sites requiring the installation of towers, towers that offered the benefits of interchangeability of sections, portability, strength, and light weight were used. These towers were supported by guy wires anchored in bedrock which is very common at higher elevations in New Hampshire.

All the brackets and towers were installed by October 1979. This equipment has performed well.

B. SENSORS

With regard to wind speed and direction sensors, a compromise was reached among the factors of price, ruggedness, responsiveness, and quality of output signal. Cup anemometers and vanes were selected with the following characteristics:

Wind Speed

| | |
|-------------------|-----------|
| Accuracy | + .25 mph |
| Range | 0-100 mph |
| Distance Constant | 8 feet |
| Threshold | 0.75 mph |

Wind Direction

| | |
|-------------------|----------|
| Accuracy | + 1.5° |
| Range | 0-360° |
| Distance Constant | 8 feet |
| Damping Ratio | 0.4-0.6 |
| Threshold | 0.75 mph |

These characteristics are moderately good in the wind measurement field. There are better anemometer systems available at greatly increased prices. In this project, the most expensive sensors were not used due to the cost of replacement. In general the sensors performed quite well in normal weather conditions. The available market into which these particular sensors fall is fairly competitive; one brand is close in quality and price to any other brand.

Unfortunately, the wind sensors used in this project have not performed completely satisfactorily. They have not survived heavy icing conditions. In particular, the anemometer cups were attached to their supporting shafts with relatively weak epoxy bonds. This drawback was alleviated during the project by a change in the anemometer design, but much data was lost. Another weakness was

associated with the wind direction measurements. Occasionally, under conditions of unusually heavy driving fog, the potentiometer on the wind vane could become wet and inoperative. This weakness was never completely solved. Several were replaced.

Out of fairness, it should be stated that wind prospecting places heavy demands on wind sensors. Many wind energy sites, almost by definition, offer severe environmental conditions. This is especially true in the mountainous sections of New Hampshire. In choosing wind sensors, a developer faces two extremes. Cheap, expendable sensors can be acquired and replaced often but at no great expense, or costly but rugged sensors can be purchased which have a much longer life. Local security conditions quite often dictate which choice to make. That is, vandalism of inexpensive sensors is not as serious a problem as damage to expensive equipment.

C. DATA LOGGERS

The data loggers were designed to gather a maximum amount of information at each site. There were eight units purchased, all with the following characteristics.

- (1) 300 foot cassette magnetic tape storage
- (2) 10 megabit storage capacity or 536,000 12 bit data words
- (3) up to 16 channels recorded
- (4) 12 bit offset binary word resolution
- (5) selectable sampling integration time from 1/2 second per sample to 64 seconds per sample
- (6) selectable sampling rate from 1/16 hour to 8 hours
- (7) adjustable threshold level to adapt sampling strategy for interesting high speed data
- (8) push button battery check
- (9) simple operation and check-out
- (10) waterproof container
- (11) battery (20 amp-hours)
- (12) temperature probe

Under normal conditions, the data loggers could record about six weeks of data without battery or tape replacement. Except at extremely low temperatures (-10°F), the data loggers performed without major problems. Each unit weighed about twenty pounds which was acceptable for backpacking. Unless

security were provided, each unit was enclosed in a locked steel box to prevent theft or vandalism.

There were considerable problems with the data loggers in the early parts of the project. The major problem was the late delivery time of both the original equipment and replacement parts. This problem is common to many areas of the digital electronics industry. Any future data gathering projects should carefully consider the lead time required in dealing with the electronics industry.

4.4 OPERATION OF EQUIPMENT

On a semi-periodic basis, staff of the Mount Washington Observatory serviced each of the monitoring sites; fresh cassettes were installed in the loggers and the used cassettes were mailed to the University for analysis. The cassettes were identified by serial numbers and were accompanied by special forms which provided instructions and documentation. Careful documentation and double checking were required to manage the amounts of data collected.

Batteries and replacement parts were supplied as needed. There were many problems encountered with vandalism, theft, and accidental mishandling of equipment. Many of these problems are common to any unmanned scientific research efforts and simply were unavoidable. Insurance was carried on the data loggers to help reduce the problem to manageable budget levels.

Table 4.1 Sites at which wind speed and direction were monitored.

| <u>Site Name</u> | <u>Elevation ASL</u> | <u>Ownership</u> |
|-------------------------|----------------------|------------------|
| 1. Dixville Peak | 3482' | private |
| 2. Wildcat Mtn. | 4415' | federal |
| 3. Moose Mtn. | 2300' | private |
| 4. Dalton Mtn. | 2142' | private |
| 5. Little Attitash Mtn. | 2518' | federal |
| 6. Cardigan Mtn. | 3121' | state |
| 7. Crotched Mtn. | 2055' | private |
| 8. Cannon Mtn. | 4040' | state, federal |



Figure 4.1 Little Attitash Mountain, looking Southeast.



Figure 4.2 Wildcat Mountain, looking East.



Figure 4.3 Cannon Mountain, looking East.

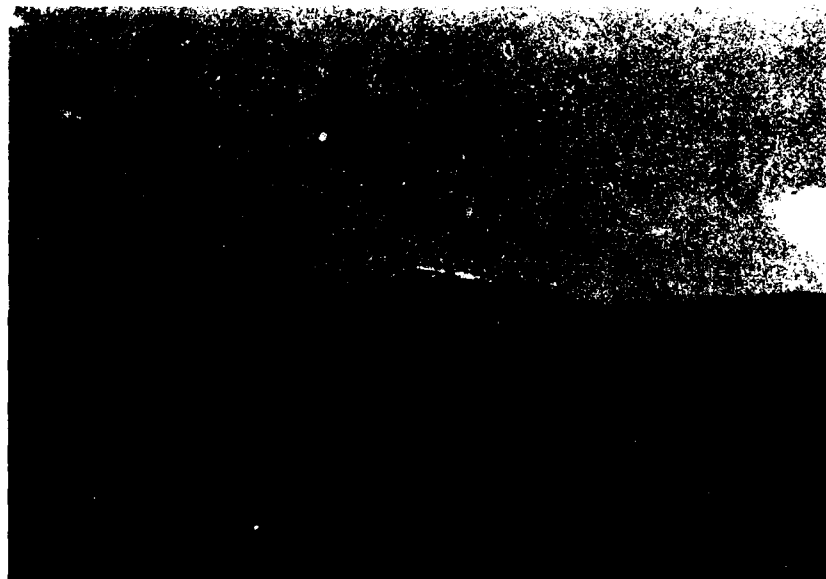


Figure 4.4 Cardigan Mountain, looking East.



Figure 4.5 Moose Mountain, looking Northwest.



Figure 4.6 Dalton Mountain, looking West.



Figure 4.7 Crotched Mountain, looking East.



Figure 4.8 Dixville Peak, looking East.

CHAPTER 5 DATA ANALYSIS

5.1 INTRODUCTION

A network of eight data collection systems has been installed in New Hampshire to quantitatively assess the wind energy resource. The results of data, collected as part of this research, are summarized in this section.

The data were taken at eight sites dispersed throughout the state at intermediate elevations of 2000-4000 feet above sea level. Power and energy output calculations for two types of wind machines are presented. The data conclusively show that there is an abundant wind energy source in New Hampshire capable of successfully operating large-scale wind energy conversion systems. Questions of reliability and predictability of the wind as an energy source are quantitatively answered. The data also show that there is no substitute for actual long-term measured wind energy data in forecasting the value of a potential site for turbine installation.

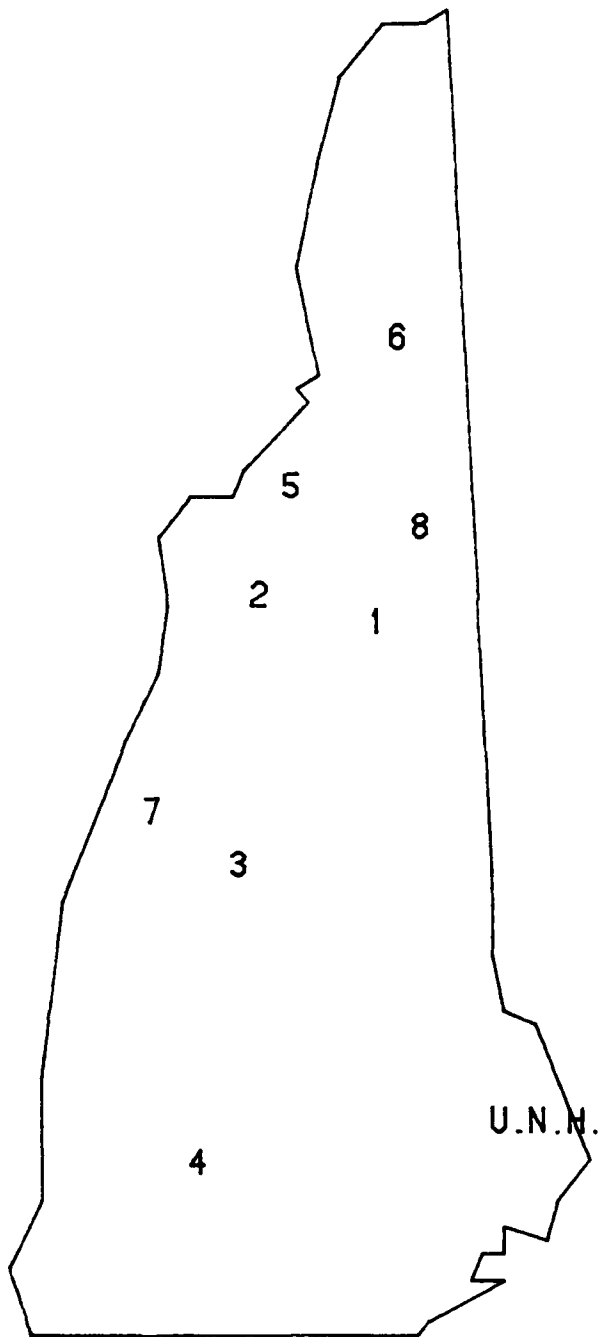
5.2 METHOD

Eight sets of cup anemometers and wind vanes were calibrated at the MIT Wright Brothers Wind Tunnel (Cambridge, Mass.). The anemometers performed as quoted in manufacturer's specifications, with a cut-in velocity under 2 mph and a nearly linear response from 2 mph to 105 mph. The cups responded in eight feet of wind, which means that the time constant for the response is less than 0.1 seconds in a 60 mph wind.¹

At each of the eight sites, cup anemometers and wind vanes were installed at a height of 10 meters above the local prevailing ground cover. At four sites this necessitated the erection of towers, while at the other four sites existing fire observation towers were used. The sites were unmanned and utility power was not available. On site, battery-operated data loggers² were used to record the data on magnetic cassette tapes. Each 300-foot tape, containing between two and six weeks of data, was then processed using computers at the University of New Hampshire.

¹More information about the sensors is contained in previous sections.

²See section for data logger specifications.



- 1 ATTITASH MTN, BARTLETT N.H.
- 2 CANNON MTN, FRANCONIA N.H.
- 3 MT. CARDIGAN, ORANGE STATE PARK
- 4 CROTCHED MTN, FRANCESTOWN N.H.
- 5 DALTON MTN, DALTON N.H.
- 6 DIXVILLE PEAK, DIXVILLE N.H.
- 7 MOOSE MTN, HANOVER N.H.
- 8 WILDCAT MTN, BEAN'S PURCHASE N.H.

FIG.5.1: LOCATIONS OF WIND RECORDERS

Table 5.1. Characteristics of Large and Small Scale Machines

| | Blade Diameter (Meters) | Generator (Megawatts) | Hub Height (Meters) | Number of Blades |
|---|-------------------------------|--------------------------|------------------------|---------------------|
| WTS 4 United Technologies) Hartford, Conn. | 77.6 | 4 | 80 | 2 |
| DB Unit (U.S. Wind Power) Burlington, Mass. | 12.1 | 0.03 | 18.2 | 3 |

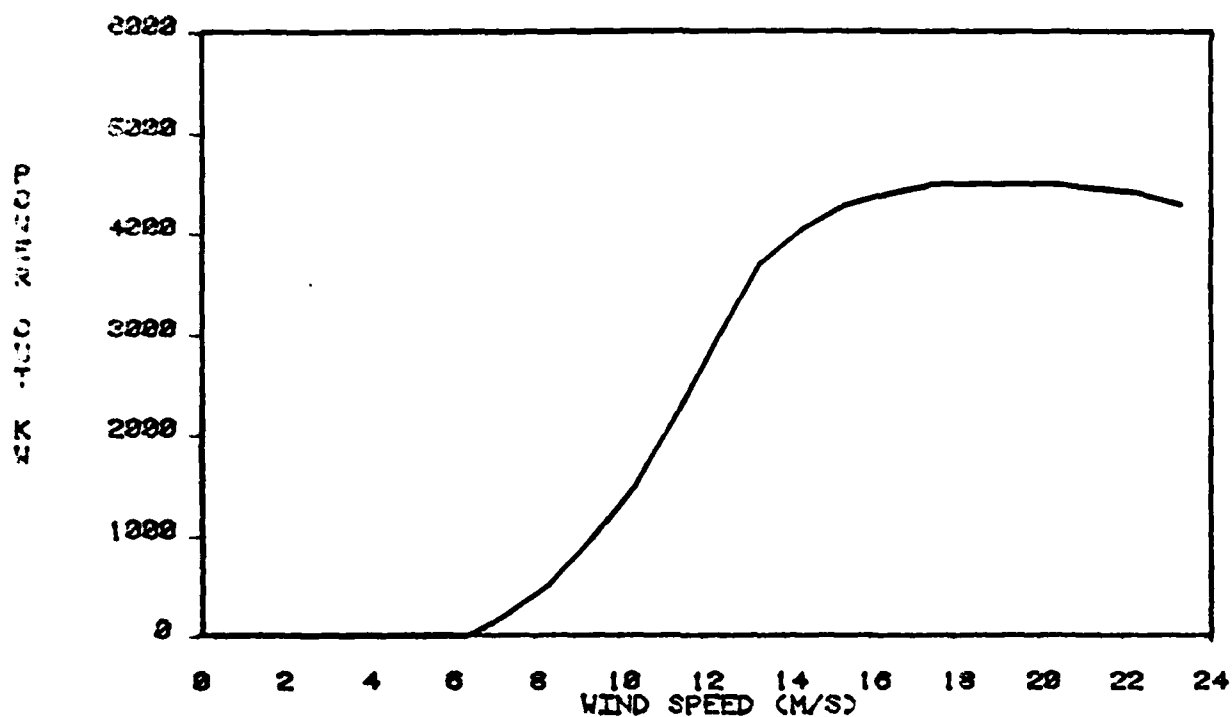


FIG.5.2: MACHINE POWER OUTPUT CURVE FOR UNITED TECHNOLOGIES WTS4 GENERATOR

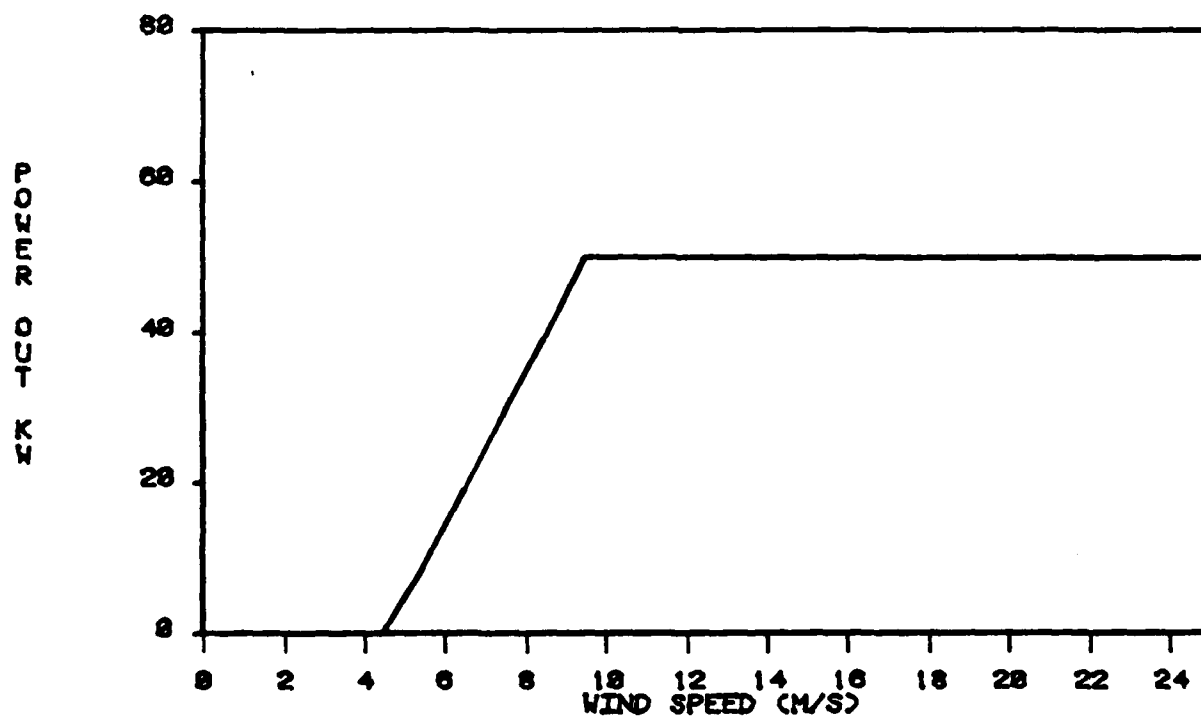


FIG.5.3: MACHINE POWER OUTPUT CURVE FOR U.S. WINDPOWER GENERATOR.

Each data logger was programmed to take groups of samples at regular intervals. Typically, every seven and one-half minutes, the logger recorded a series of sixteen samples, spaced four seconds apart. If the average wind speed recorded in these samples exceeded a threshold (18 mph), the data logger then took a second "burst" of samples also spaced four seconds apart. The "burst" data, which usually consisted of 128 samples, was used to examine the "gustiness" of the wind.

At the University of New Hampshire four-second sample data were converted into one-half hour averages and stored on magnetic reel tape. The half-hour average data were applied to machine power output curves of both a large scale (4 MW) wind turbine built by Hamilton Standard of United Technologies (Windsor Locks, Conn.), and to a small scale (50 kW) turbine built by U.S. Windpower, Inc. (Burlington, Mass.). The characteristics of these two machines are given in Table 5.1 and Figures 5.2 and 5.3.

Wind speed at the anemometer height was adjusted to hub-height wind speed by the equation:

$$V_1 = V_2 (H_1/H_2)^r$$

where V_1 is the wind speed at hub height, V_2 is the speed measured by the anemometer, H_1 is the hub height of the machine, H_2 is the height of the anemometer and r is the wind shear power law exponent, typically equal to 0.2.

5.3 DISCUSSION OF DATA

The average wind speeds are summarized in Table 5.2. An appendix to this section contains the detailed summaries for each of the eight sites. The maximum measured average speed of 21.3 mph occurred at Mt. Cardigan. All eight sites exhibited an average speed sufficiently high to operate most wind turbines. At some locations the data were taken only during the months (July-Dec.) which typically have lower average wind speeds than the overall annual average. This indicates that the annual average speeds may

Table 5.2. Data Summary

| Location | Mean Wind Speed mph(m/s) | Extrapolated Annual Wind Speed mph(m/s) | Elevation Above Sea Level in Feet | Length of Data Record in Days | On-time Factor ³ | Capacity Factor ⁴ WTS4 | Capacity Factor ² USWP | Power in Wind at 60 Meters in Watts/ Square Meter |
|------------------|-----------------------------|---|---|-------------------------------------|--------------------------------|---|---|---|
| Attitash Mtn. | 14.1(6.4) | 13.8(6.3) | 2518 | 137 | 66 | 37 | 38 | 1315 |
| Cannon Mtn. | 16.9(7.7) | 19.4(8.8) | 4060 | 50 | 77 | 46 | 48 | 2272 |
| Mt. Cardigan | 21.3(9.7) | 26.4(12.0) | 3121 | 70 | 94 | 77 | 75 | 2796 |
| Crotched Mtn. | 17.2(8.0) | 17.8(8.1) | 2055 | 40 | 92 | 57 | 61 | 1705 |
| Dalton Mtn. | 11.7(5.3) | 11.4(5.2) | 2042 | 96 | 67 | 25 | 28 | 593 |
| Dixville Peak | 16.9(7.7) | 14.5(6.6) | 3482 | 119 | 89 | 55 | 56 | 1426 |
| Moose Mtn. | 11.7(5.3) | 11.4(5.2) | 1890 | 188 | 70 | 21 | 25 | 528 |
| Wildcat Mtn. | 16.3(7.4) | 21.3(9.7) | 4415 | 18 | 80 | 44 | 46 | 1861 |

1. WTS4: United Technologies 4 MW machine

2. USWP: US Windpower, Inc. 50 Kw machine

3. On-time factor is defined as the ratio of the time the wind was above 9 mph to the total time of data record.

4. Capacity factor is defined as the ratio of the actual power output to the total possible power output if the machine were operating at full rated power all the time.

be somewhat higher. An extrapolated, yearly average prediction is included in Table 5.2 to reflect these monthly trends. This trend was confirmed by processing 28 years of data from Concord Airport in Concord, N.H. The average yearly trend and a typical yearly trend from one year (1976) are shown in Figure 5.4.

Figure 5.4 also shows that there is no substitute for long-term data collection. The yearly averages at Concord (1948-76) varied from 5.64 mph in 1957 to 8.16 mph in 1971. The 29-year overall average was 6.84 mph. Any single yearly average can be used as an estimate of the long-term average but, for example, if 1971 were used as a sample, there would have been an error of more than 19%. Since the mean wind speed is cubed in power predictions there could be up to a 70% error in the average power estimate. Clearly there is no substitute for long-term data collection when accurate power predictions are required.

It should be noted that elevation above sea level did not correlate highly with average wind speed. For example, the highest wind speed did not occur at Cannon Mountain which had the highest elevation. This fact is further demonstrated in Figure 5.5. The correlation coefficient was 0.51 on a scale where ± 1.0 indicates perfect correlation and 0.0 represents no correlation.

In general, wind speeds during the winter months (Dec.-Feb.) can be expected to be higher than the annual average. However, the data recorded by cup anemometers during the winter months are subject to periods of uncertainty due to icing of the cups, particularly during high wind speeds. Some high speed readings are distorted or lost completely due to icing. De-icing the cups was impractical because power was unavailable. The data was inspected visually for obvious periods of icing and those points were excluded from the summaries.

5.4 NETWORK RELIABILITY

The reliability of wind energy essentially determines the value of the resource to supplement conventional fuels in a utility grid system. The more reliable the source the more capacity credit and hence, the more the

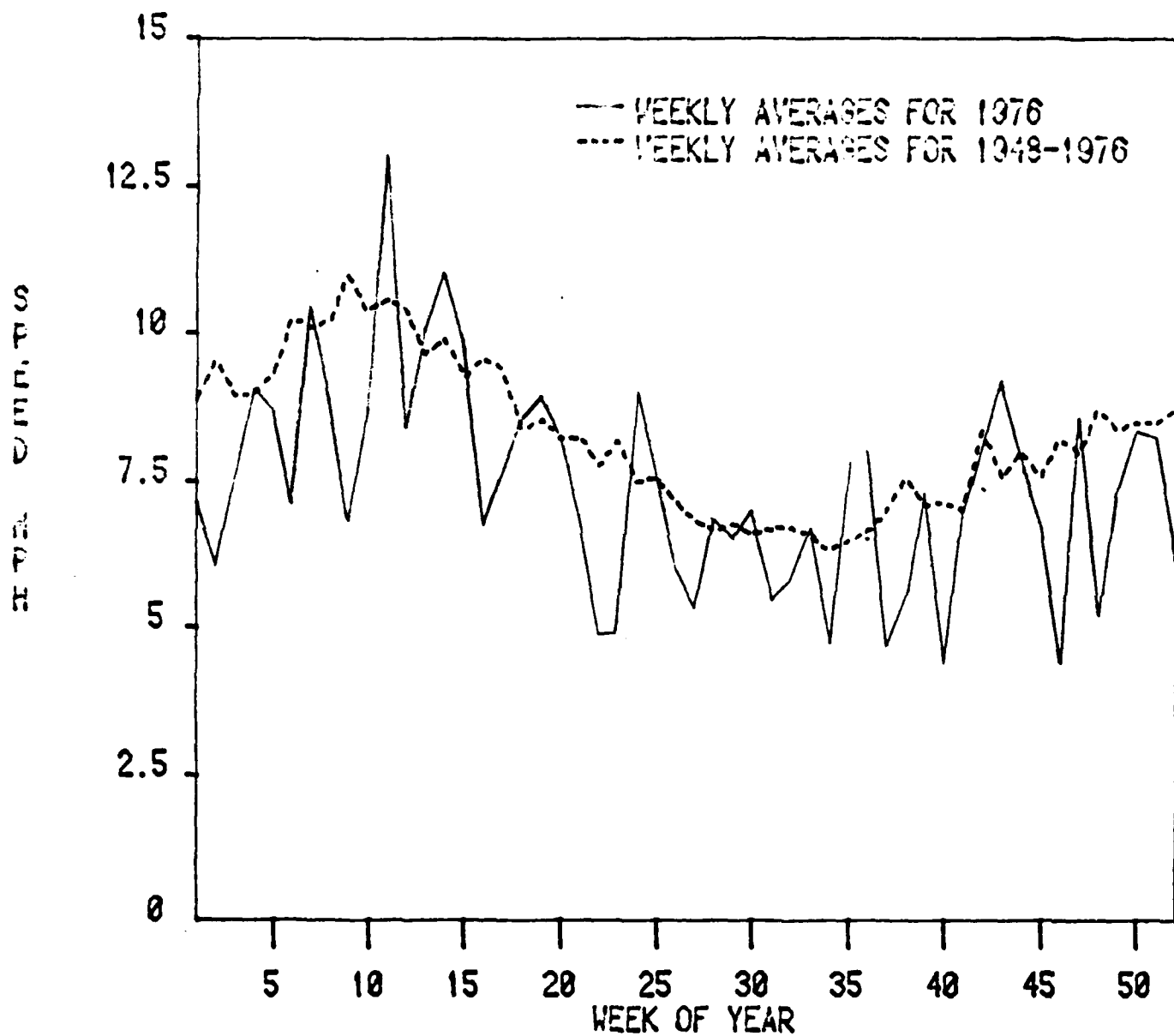


FIG.5.4: PLOT OF WEEKLY AVERAGES AT CONCORD AIRPORT FOR 28 YEARS AND ONE YEAR

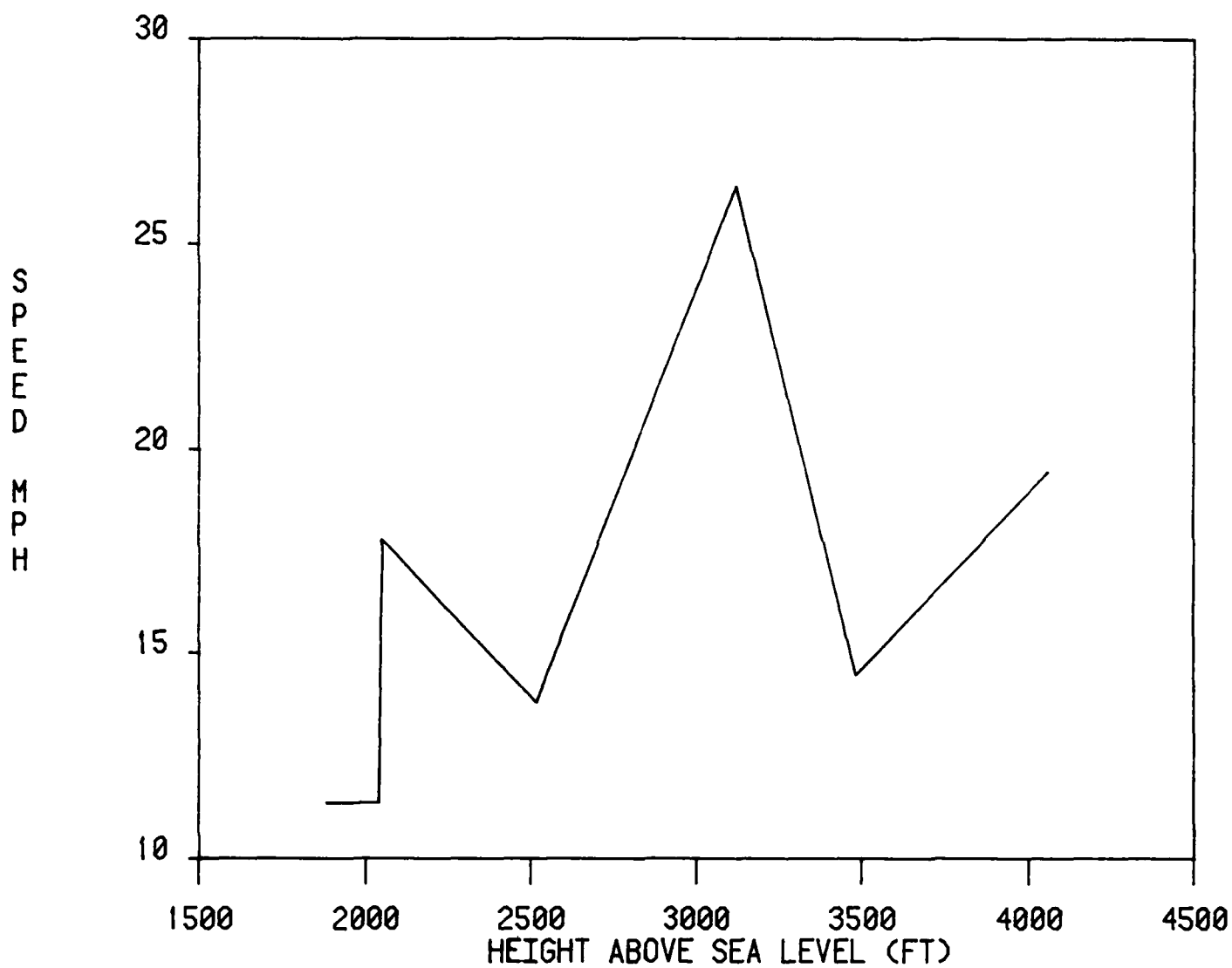


FIG.5.5: PLOT OF EXTRAPOLATED YEARLY MEAN WIND SPEED VS. SITE ELEVATION

Utility company is willing to pay for the energy.¹ One of the most important statistics of network reliability is the number of wind turbines in the system that could be expected to produce power at the same time. Two measures of reliability of the network are shown in Figure 5.6 and Figure 5.7. Figure 5.6 shows, for example, that at least two of the five installations would have sufficient wind to operate (9 mph) 94% of the time. Another interpretation is shown in Figure 5.7. That is, 20% of the network could be operating 96% of the time. These numbers were compiled for the five sites with the longest simultaneous data records available. Obviously, the sample is limited, but the idea is that there is virtually zero probability that all turbines in any large-scale network would be inoperative simultaneously.

5.5 SHORT-TERM AVERAGE WIND SPEED FORECASTING

Short-term wind speed forecasting is extremely important to large-scale wind energy commercialization, particularly when networks of wind conversion systems are connected to the electric power grid. The ability to predict the average wind speed would provide the utility companies with lead time to bring additional generators on or off the line as required. In this section, a technique used to predict the average wind speed one-half hour in the future is summarized and the results are presented for a typical site. The results indicate that it is possible to predict average wind speeds for short time intervals in the future.

The basic idea is to assume that the future average wind speed is related to past and present measurements. This relationship can be described by a difference equation with unknown coefficients. By fitting the measured data to the difference equation an optimal set of coefficients is selected to minimize the error between the actual data and the difference equation model. Once the optimal model is selected, the average wind speed 1/2 hour in the future can be predicted from past and present data measurements. For details of the linear least square technique the reader is directed to the standard texts (14).

¹ See section 6.6C. at the end of this report for a more detailed discussion of capacity credit.

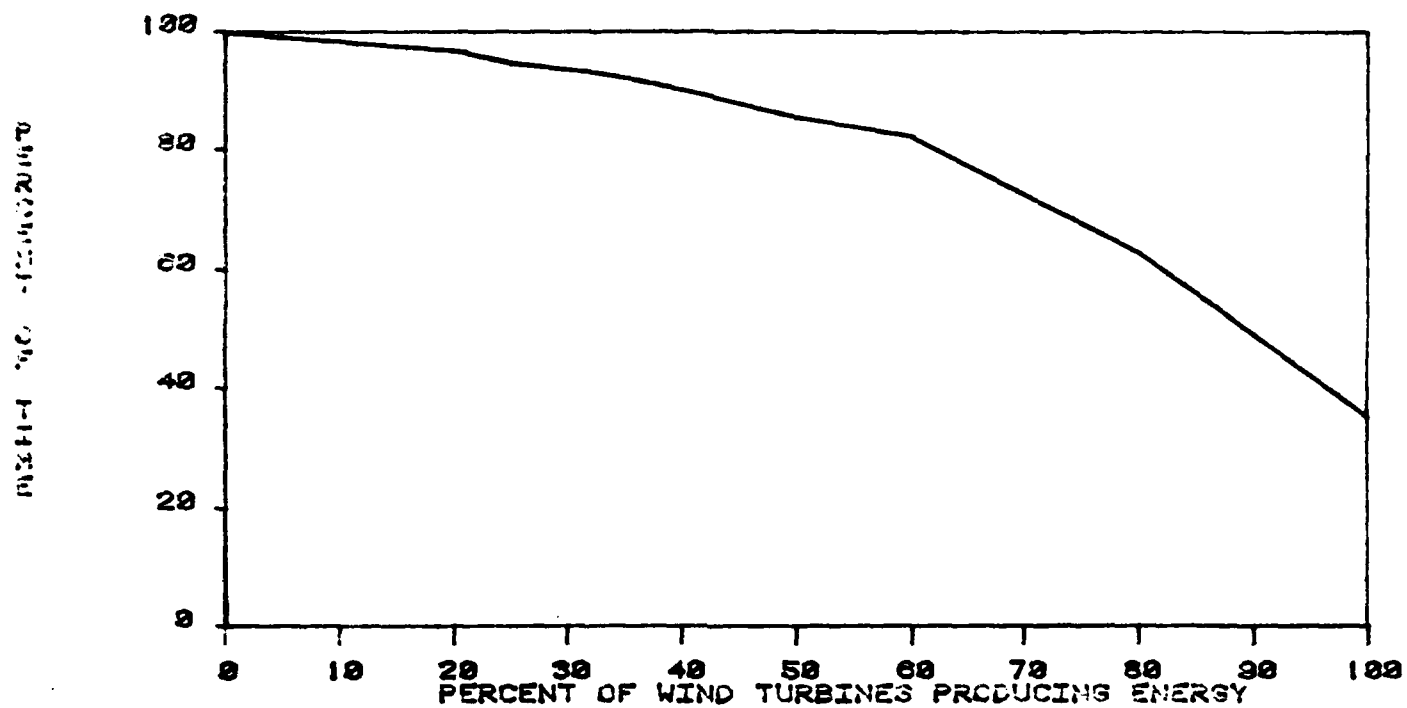


FIG.5.6: NETWORK RELIABILITY AS A PERCENT OF TIME WITH 4 M/S CUT IN

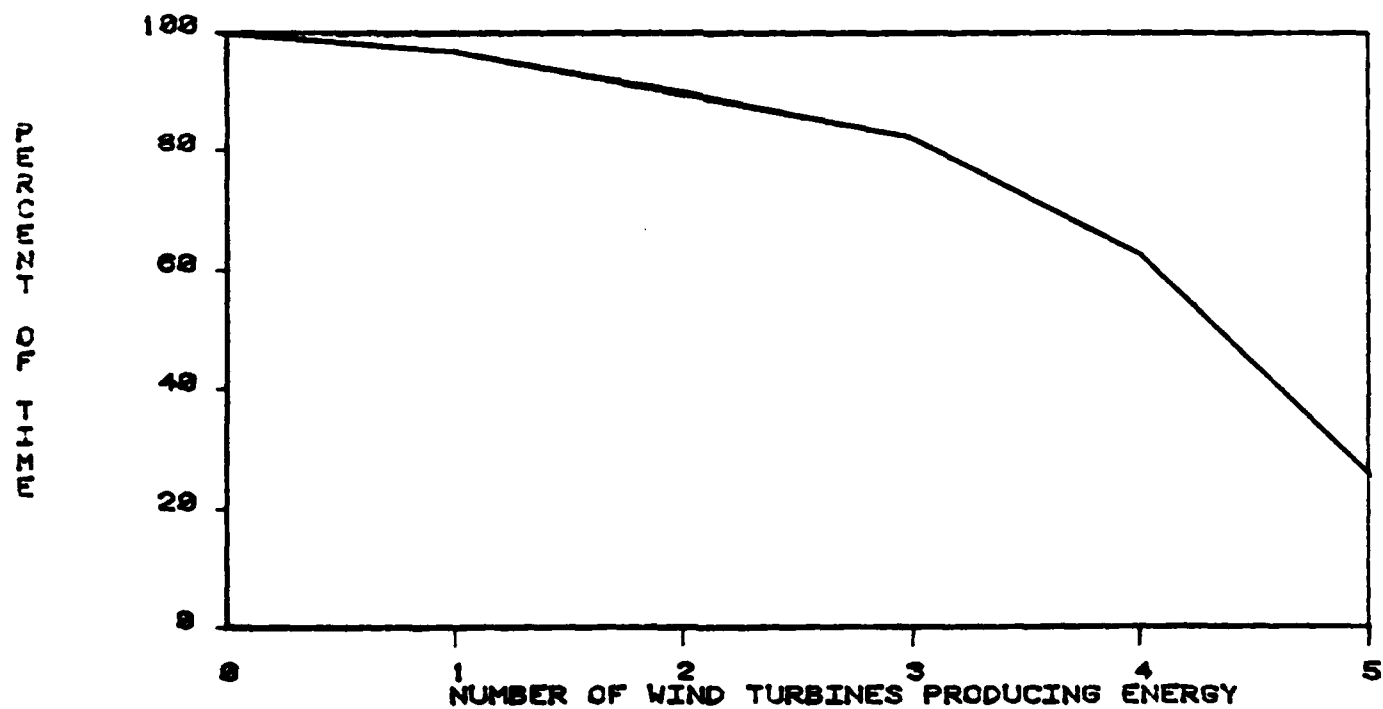


FIG.5.7: NETWORK RELIABILITY AS DETERMINED WITH FIVE DATA LOGGERS

The linear least square approach was applied to a data set taken from Concord Airport. The results are shown in Figure 8. The dotted line represents the estimate or prediction of average wind speed and the lighter line is the actual measured data. The two curves are quite similar which indicates that the least squares model "fits" the (Concord) data. These results demonstrate that it is feasible to predict average wind speed one-half hour ahead. The algorithm can easily be implemented on any basic microprocessor.

The half-hour ahead predictions can be used to schedule the operation of back-up diesel generators or other conventional power generation machinery. The advance warning time can significantly help the power company to deal with a dynamic power source in much the same manner that they now handle a dynamic load.

5.6 COMPARISON WITH OTHER WIND RESOURCE ASSESSMENTS

With the exception of Mt. Washington and Concord Airport, there has been very little wind energy data collected in New Hampshire prior to this UNH-Navy project. There were three state-wide assessments made in 1979 which suggested wind speed estimates based primarily on factors other than actual wind measurements. In this section comparisons are made between the predictions in these three surveys and the actual measured wind data. The comparisons indicate that although there is some correlation between predictions and actual measurements, there really is no substitute for long-term reliable measurements at specific sites.

Mt. Cardigan is the only site studied by all four surveys, the UNH-Navy project, the Stanford Research Institute (SRI) report (9), the Arthur D. Little (ADL) report (10) and the Illinois Institute of Technology Research Institute (IITRE) report (8). Table 5.3 shows the comparison for estimated annual average wind speed.

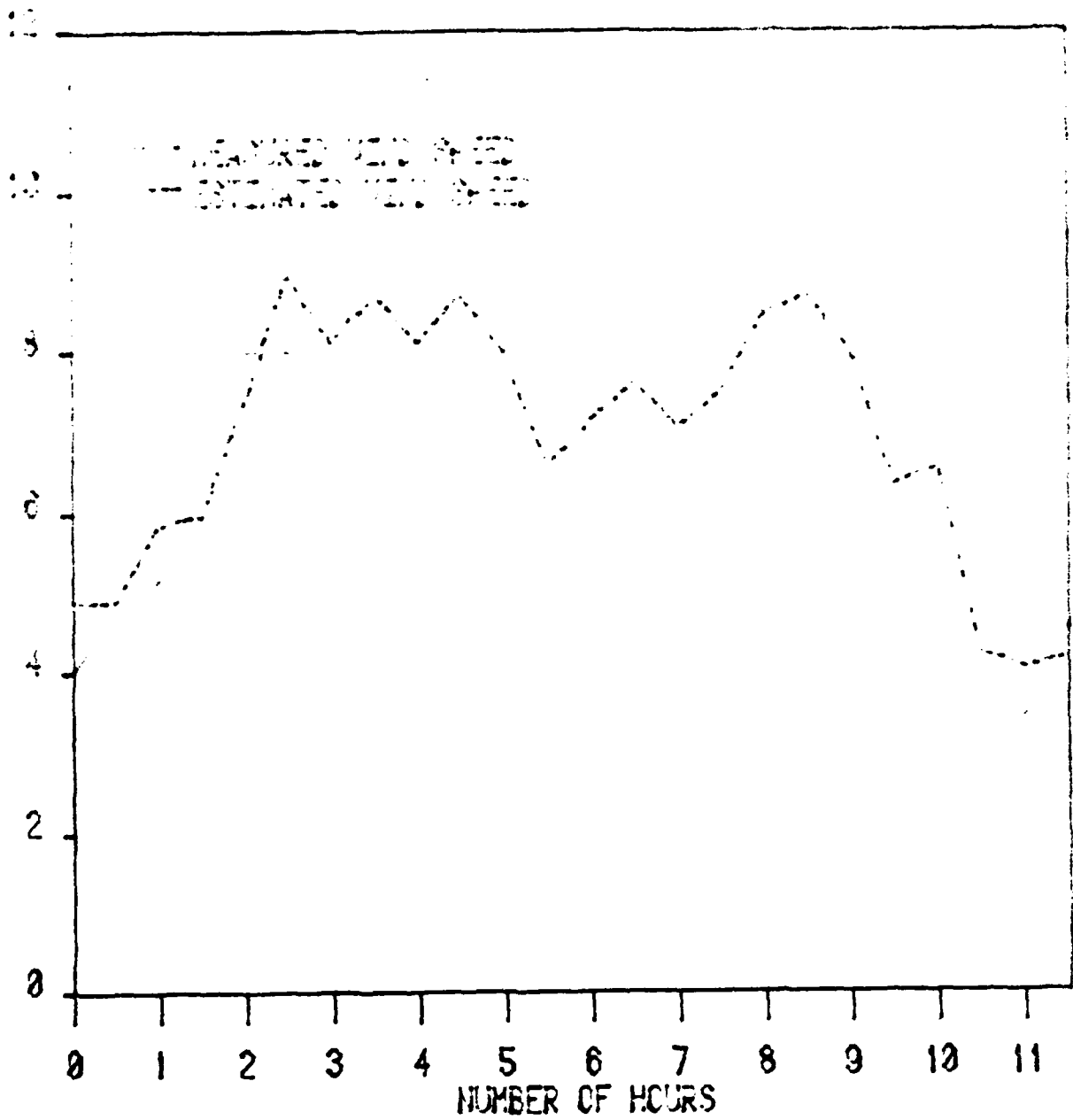


FIG. 5.9: ACTUAL VS. PREDICTED WIND SPEEDS ESTIMATED WIND SPEED IN A. 1. 1. 1.

TABLE 5.3 Estimated Annual Wind Speed at Cardigan Mountain

| IITRE | ADL | SRI | UNH-NAVY |
|-------------------------|-----------|------------------------|-------------------------|
| 11.3 m/sec ¹ | 7.4 m/sec | 9.4 m/sec ² | 12.0 m/sec ³ |

1. Based on short term measurement August 6-19, 1979 and extrapolated to reflect monthly trends at Concord Airport as shown in Figure 5.4.
2. Based on elevation above sea level only.
3. Based on 70 days of data from November-April 1980-81 and extrapolated according to Concord Airport data in Figure 5.4.

The data in Table 5.3 show that the annual estimates vary as much as 62% from the 12.0 m/sec UNH-Navy measured average data. This error is compounded in power output predictions because the power is proportional to wind speed cubed. This means that power predictions could be off by a factor of 4.3. The UNH-Navy data is certainly not the complete answer either, however, because it is based on a relatively short data record. The point is demonstrated clearly. There is no short-cut to accurate average annual wind speed forecasting. A long-term reliable measured data record is the only sure method to accurately predict the average annual wind speed.

5.7 CONCLUSIONS

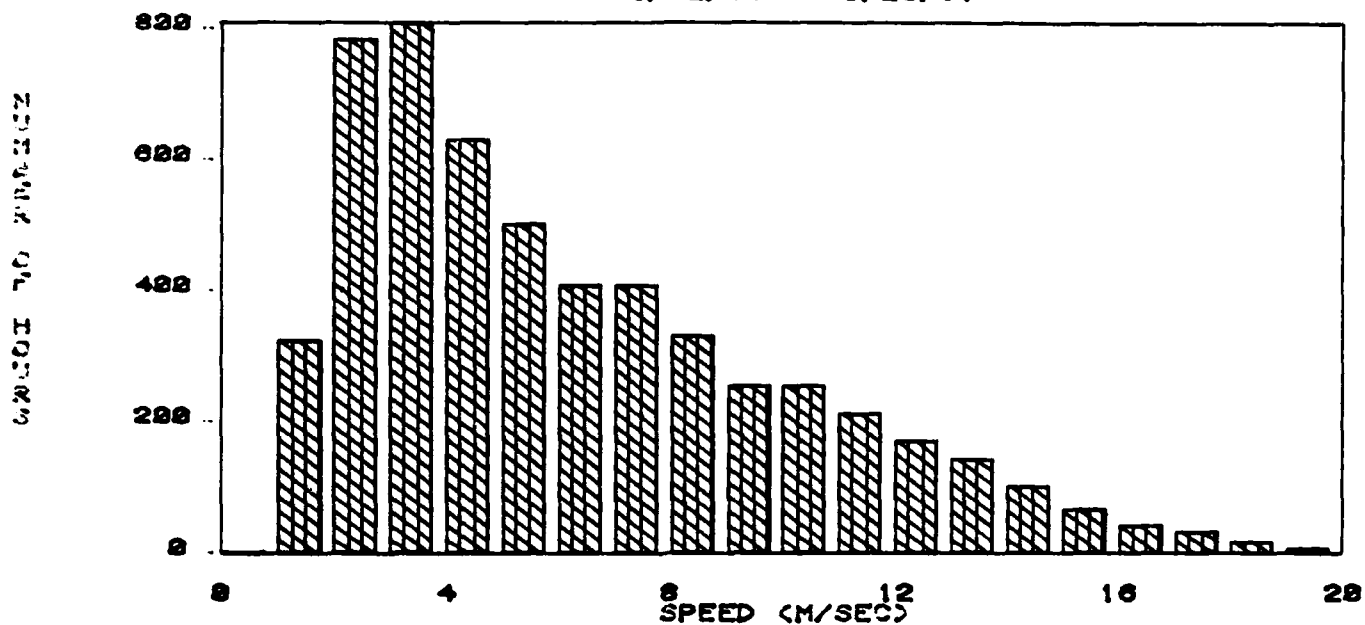
The research reported in this paper has quantitatively shown that New Hampshire has an abundant wind energy resource at intermediate elevations above sea level. The power output data calculated shows that a network of large-scale turbines or wind farms dispersed throughout the state would be a viable addition to the normal utility grid picture. The data also has demonstrated that short-term half-hour predictions of average wind speeds are possible using simple algorithms that could be implemented on microprocessors. The correlation between elevation above sea level and average wind speed has been shown to be quite low. The correlation between non-measured estimates of average wind speed and actual measured long-term wind speed average has also been shown to be low. These two correlations support the need for long-term data collection at individual sites as opposed to regional estimates. The research has acted

as the catalyst in stimulating wind energy commercialization in New Hampshire by bringing manufacturers of wind turbines in contact with potentially successful locations for installation of wind turbines. One such site is now in operation at Crotched Mountain, Franconia, N.H. Clearly, the potential for large-scale wind energy harvesting is present in New Hampshire.

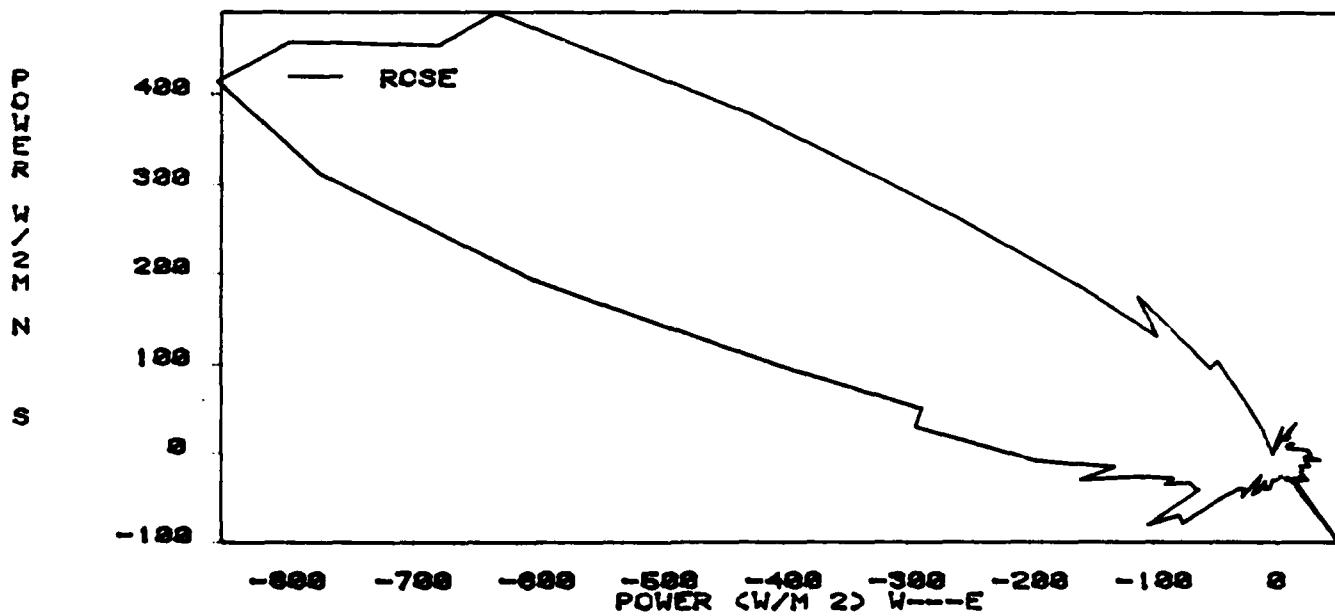
APPENDIX

The following pages contain the histograms and wind rose plots for the eight data collection sites. The wind speed histogram is given in number of hours versus wind speed in meters per second. The wind rose is given as average power in watts per square meter in the directions indicated. North is shown at the top of each page. West is to the left of the page. For example, to determine the average power in the wind coming from the northwest, find the 0-0 point according to the X-Y axis labels. Then draw a line to the intersection point on the rose in the NW direction (45° counterclockwise from north). The length of this line determines the average power in watts per square meter as shown on the scales on the X-Y axis.

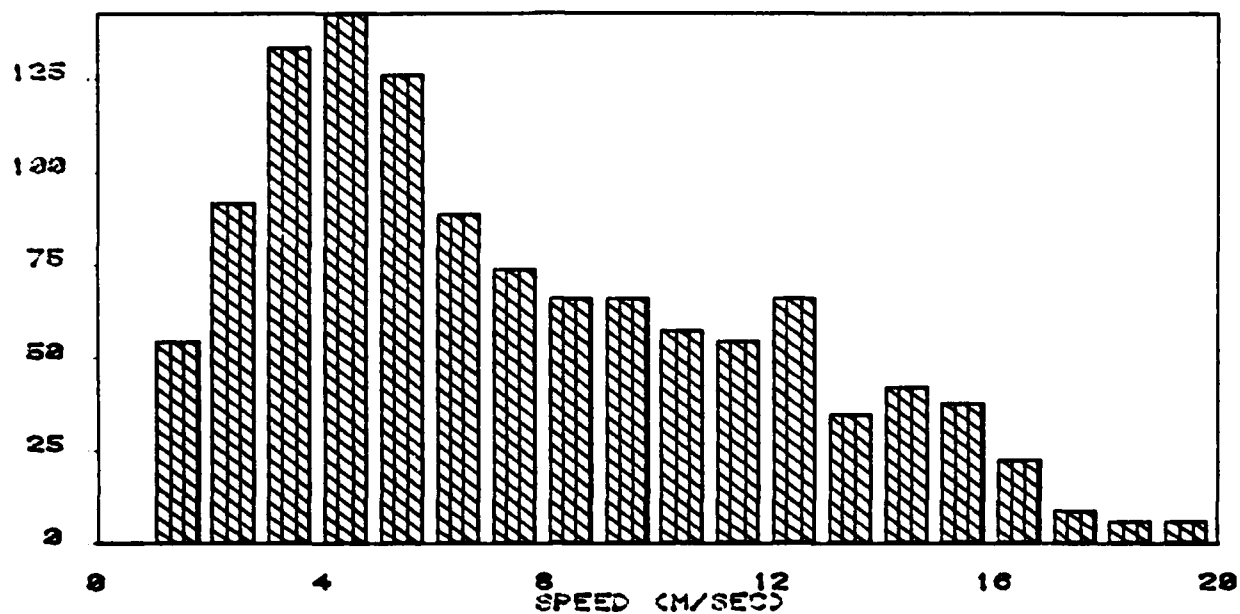
MT ATTITASH
8/ 2/80 - 5/28/81



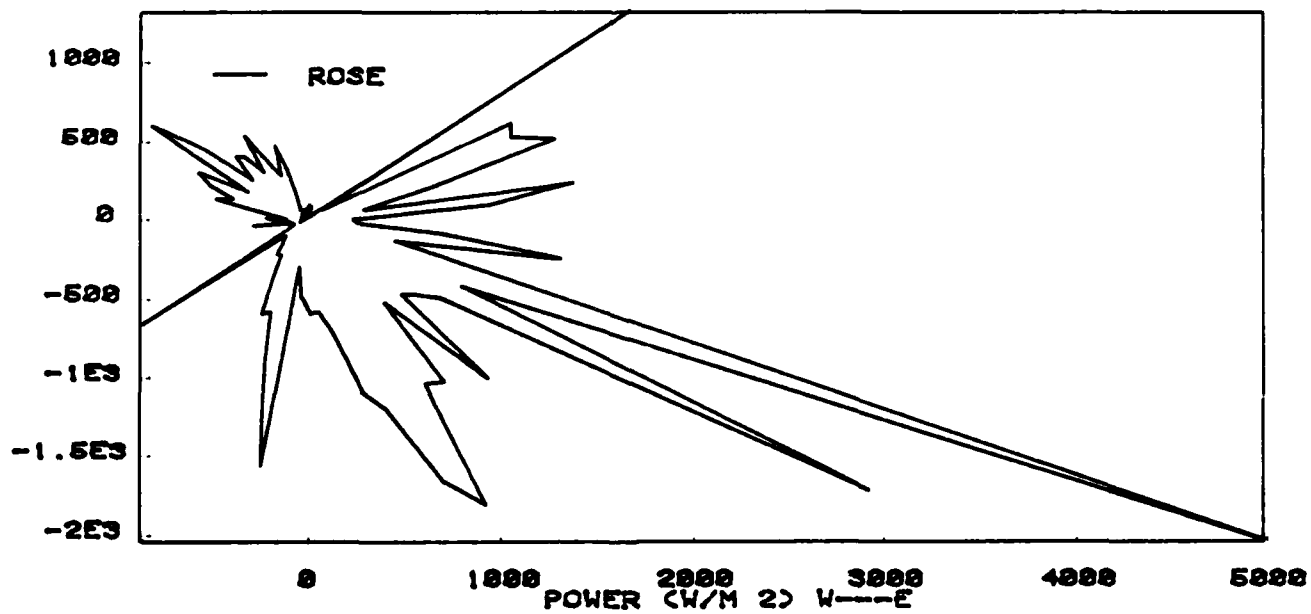
WIND ROSE— MT ATTITASH
8/ 2/80 - 5/28/81



CANNON MT
2/ 8/82 - 11/11/82

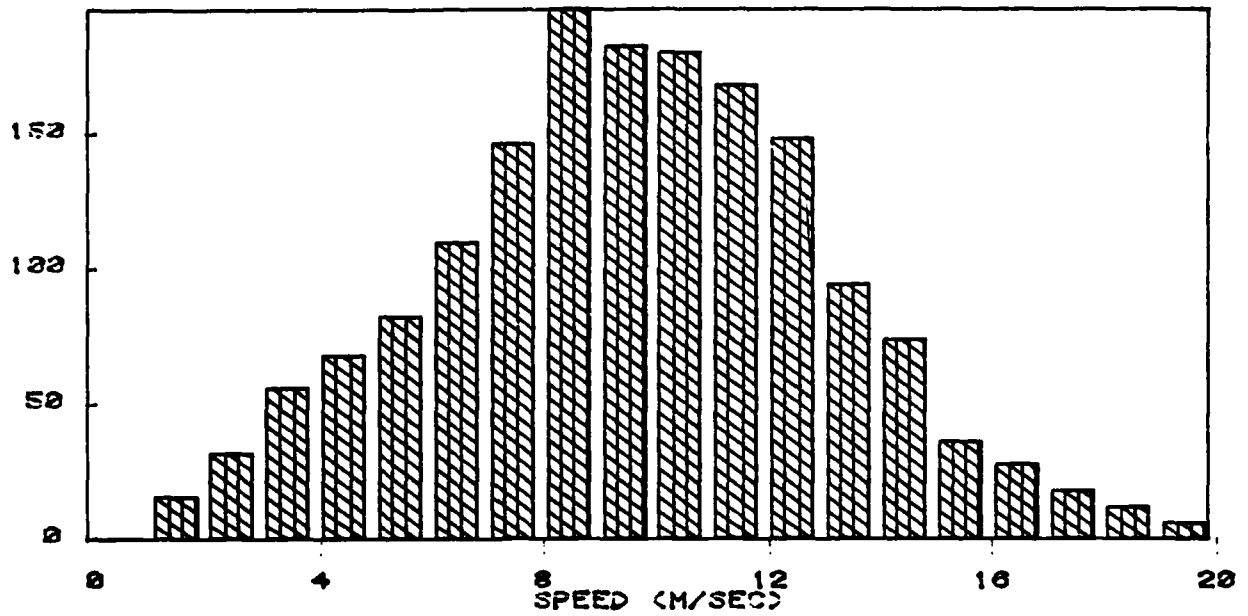


WIND ROSE— CANNON MT
2/ 8/82-11/11/82



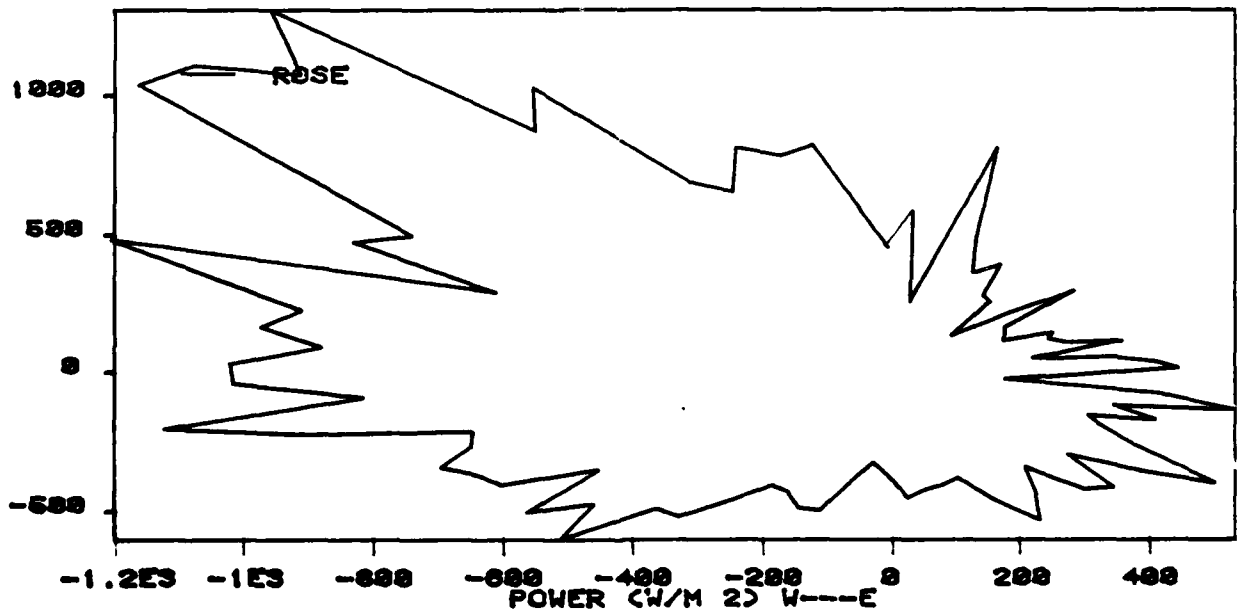
MT CARDIGAN
7/11/80 - 11/3/80

WIND SPEED FREQUENCY

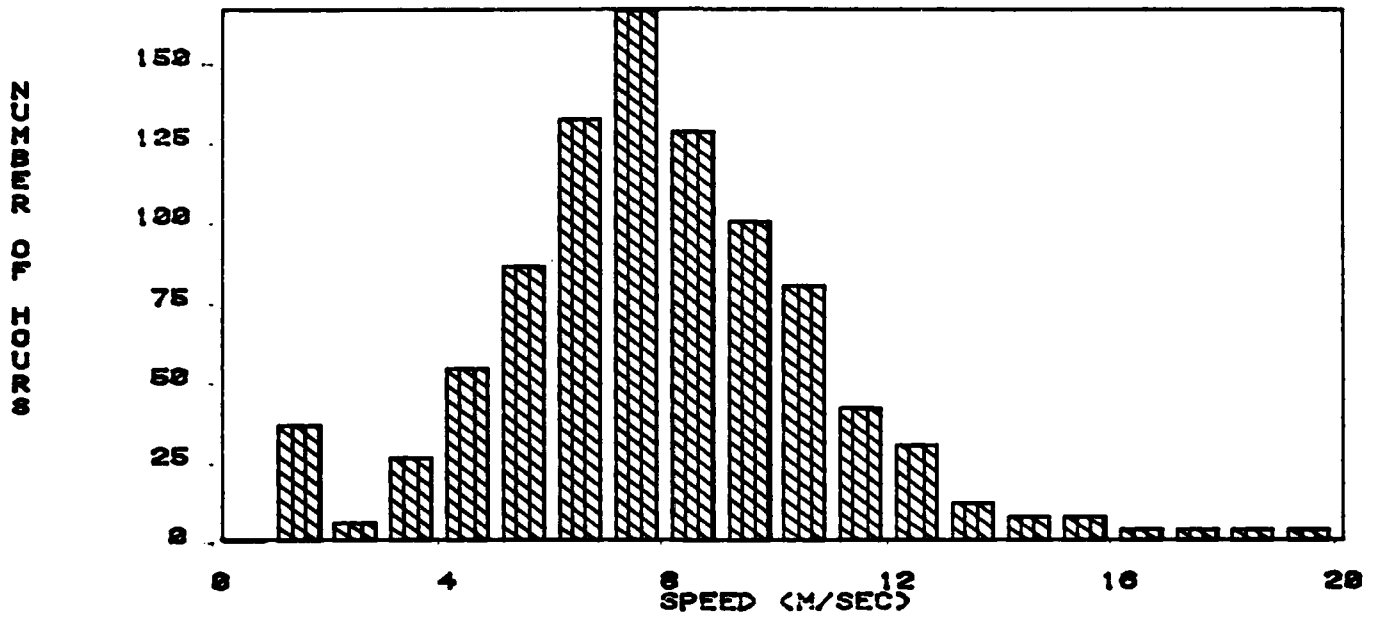


WIND ROSE-- MT CARDIGAN
7/11/80-11/3/80

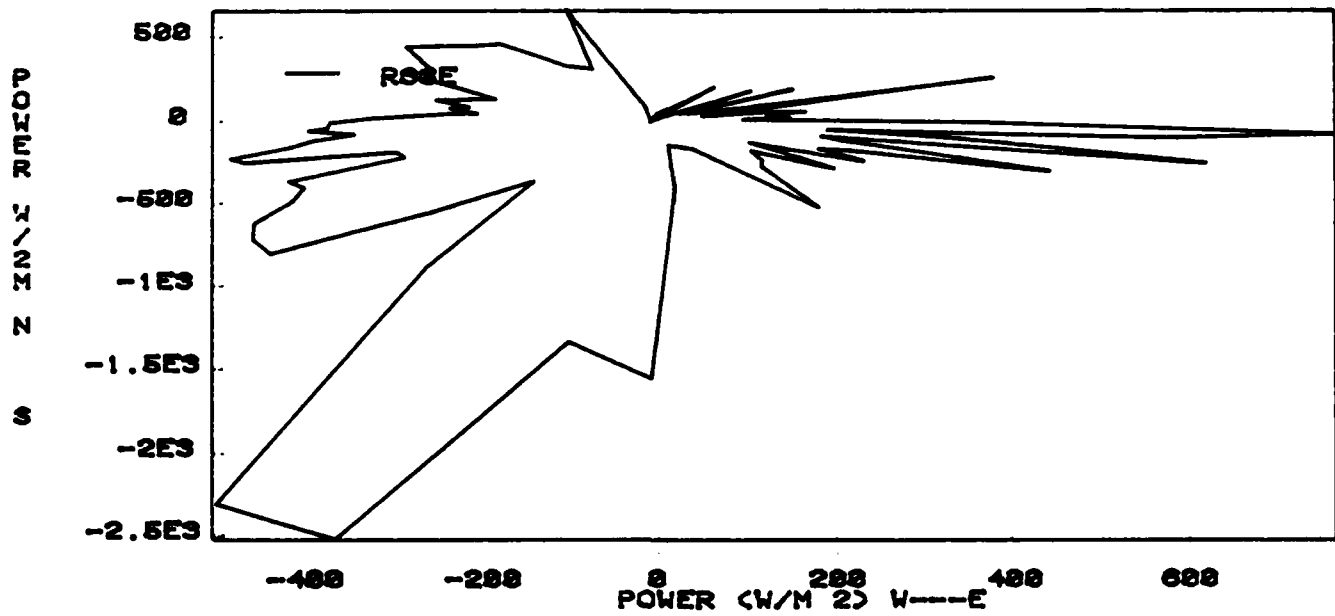
POWER (W/M²)



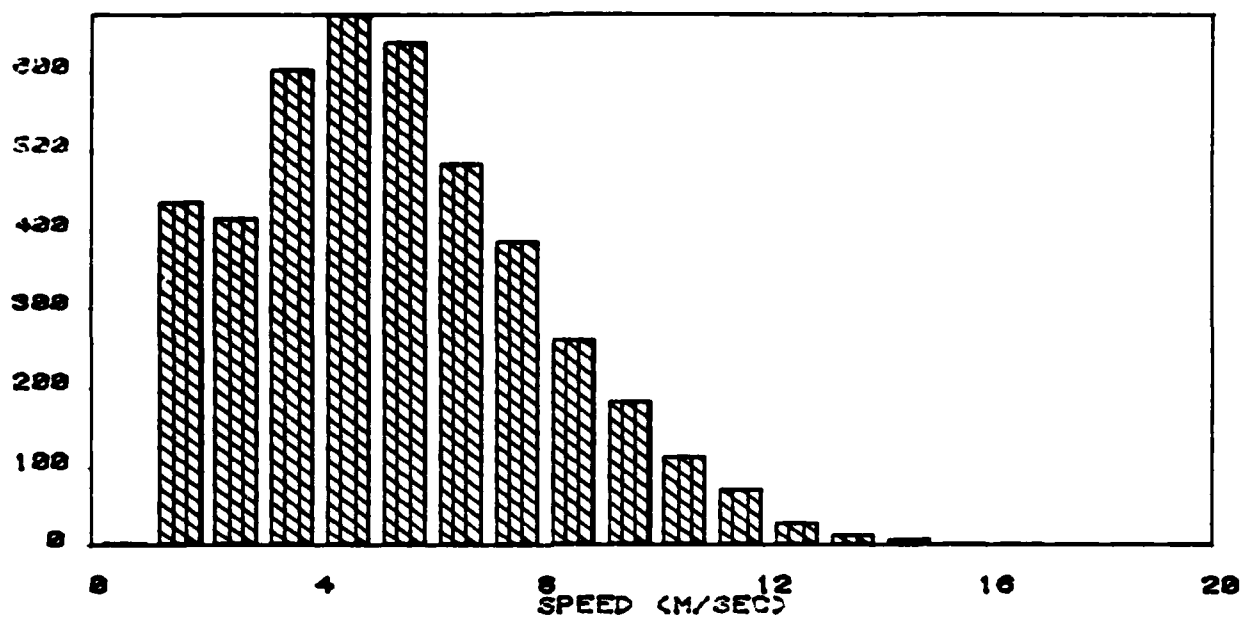
CROTCHED MT
7/10/80 - 2/10/81



WIND ROSE-- CROTCHED MT
7/10/80 - 2/10/81



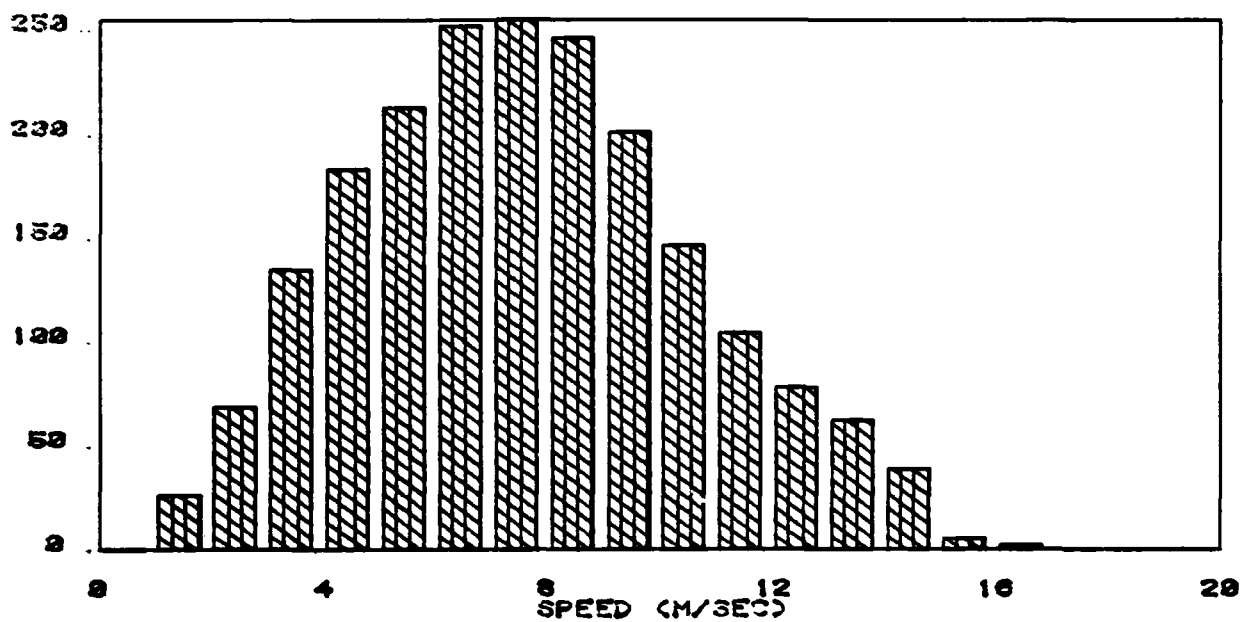
DALTON MT
8/13/88 - 5/15/91



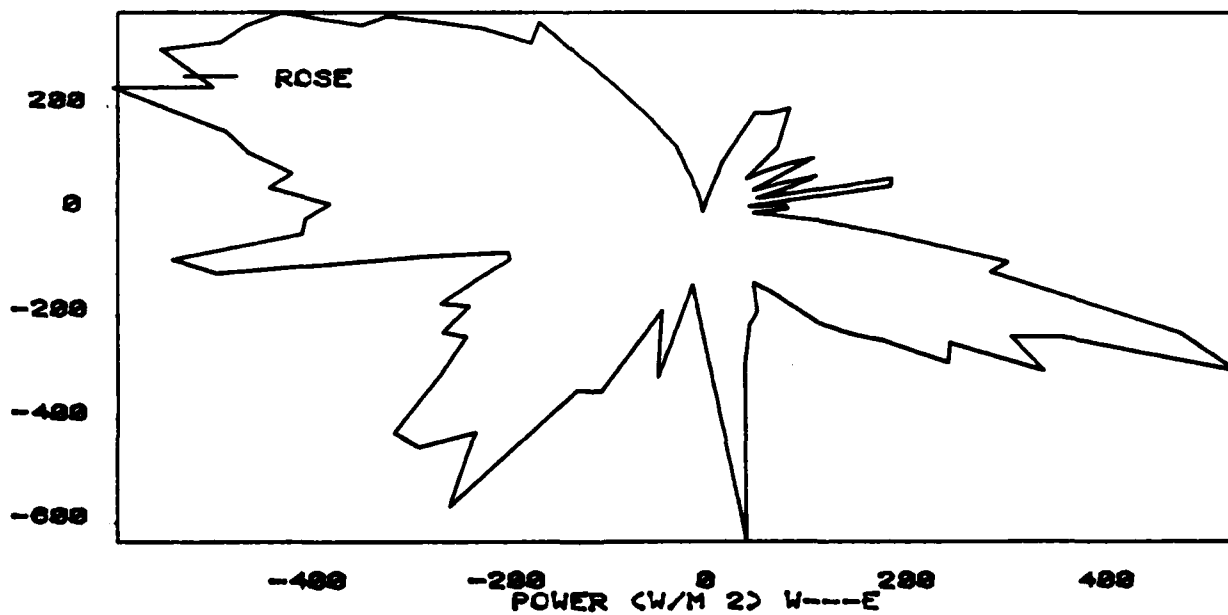
WIND ROSE-- DALTON MT
8/13/88 - 5/15/91



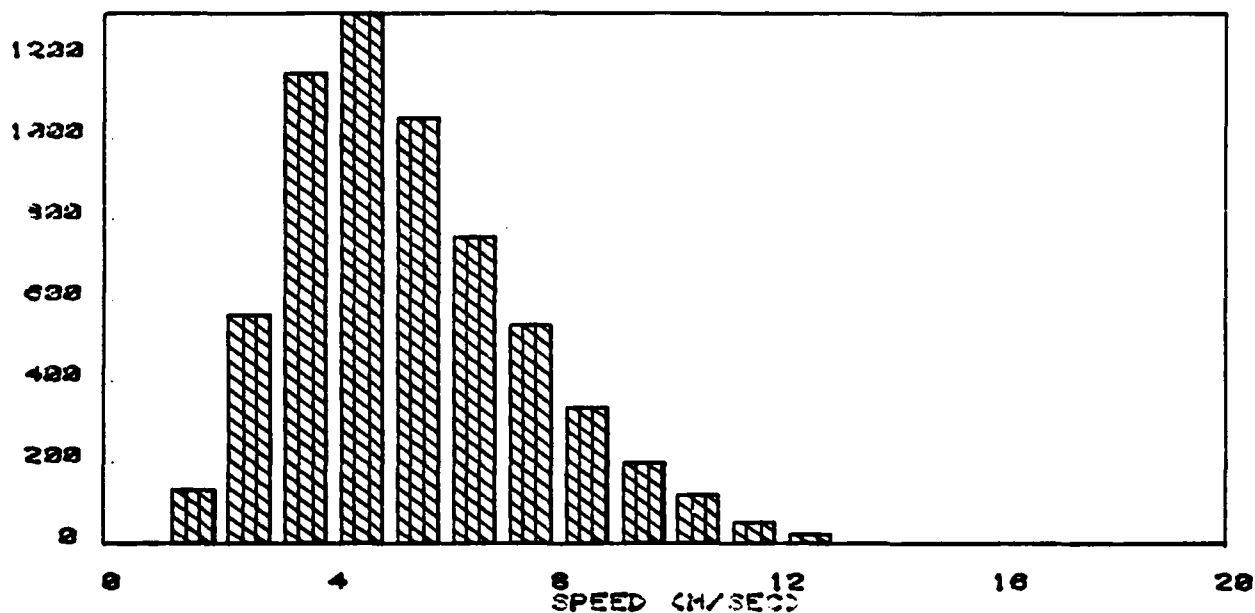
DIXVILLE MT
1/27/81 - 5/27/81



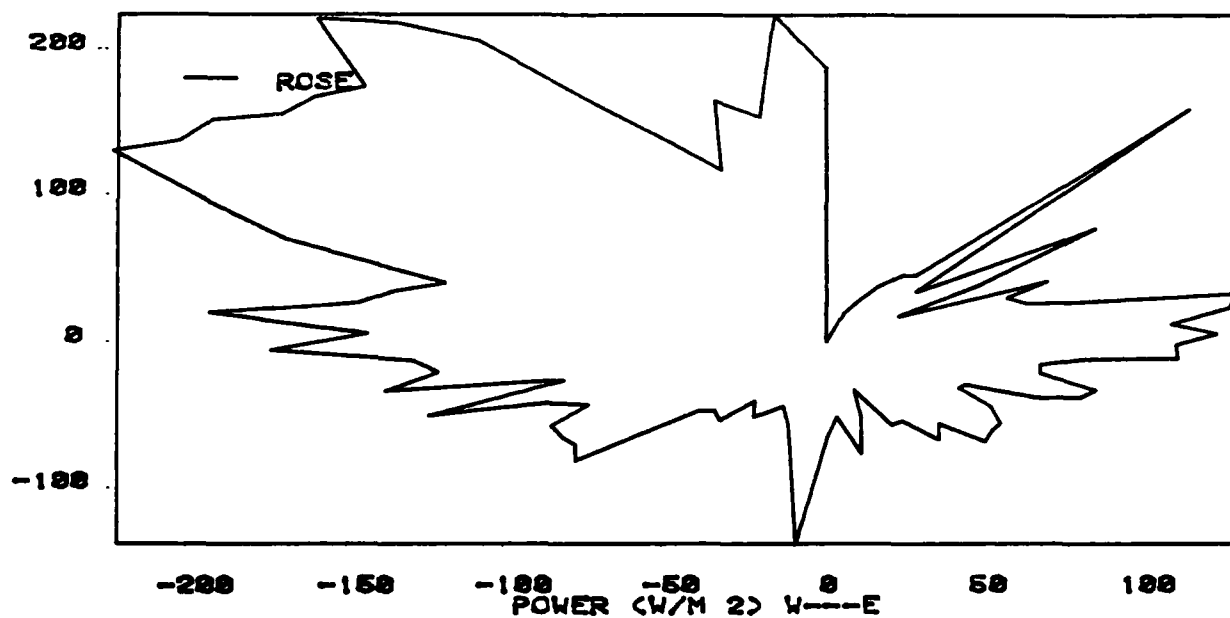
WIND ROSE-- DIXVILLE MT
1/27/81 - 5/27/81



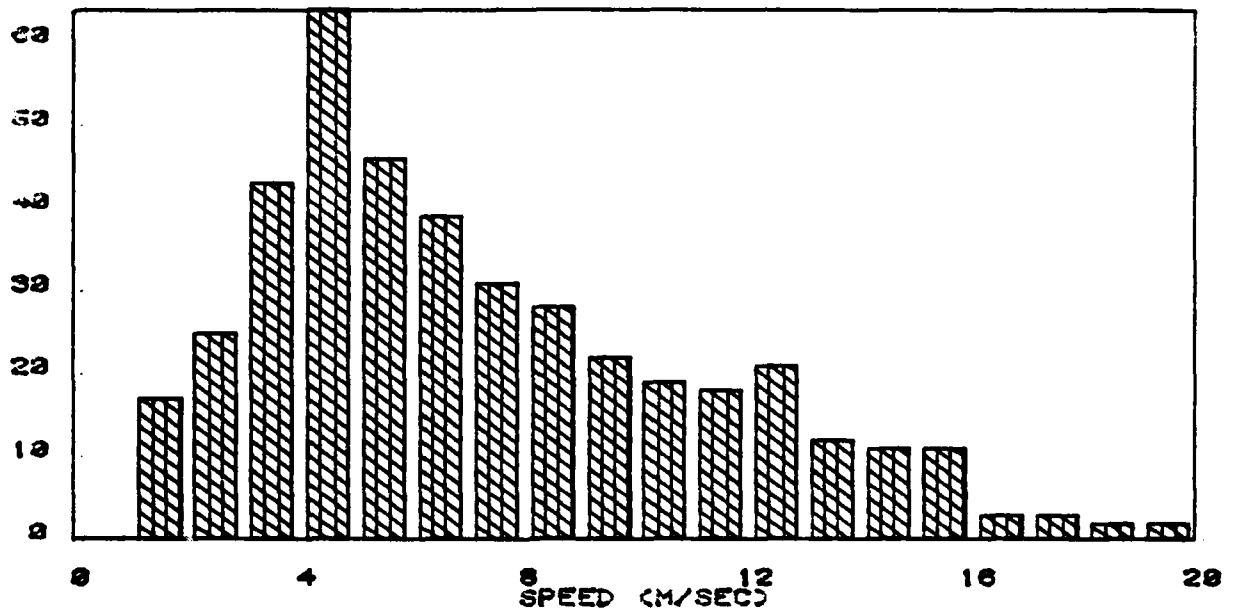
44
MOOSE MT
7/29/80 - 5/27/81



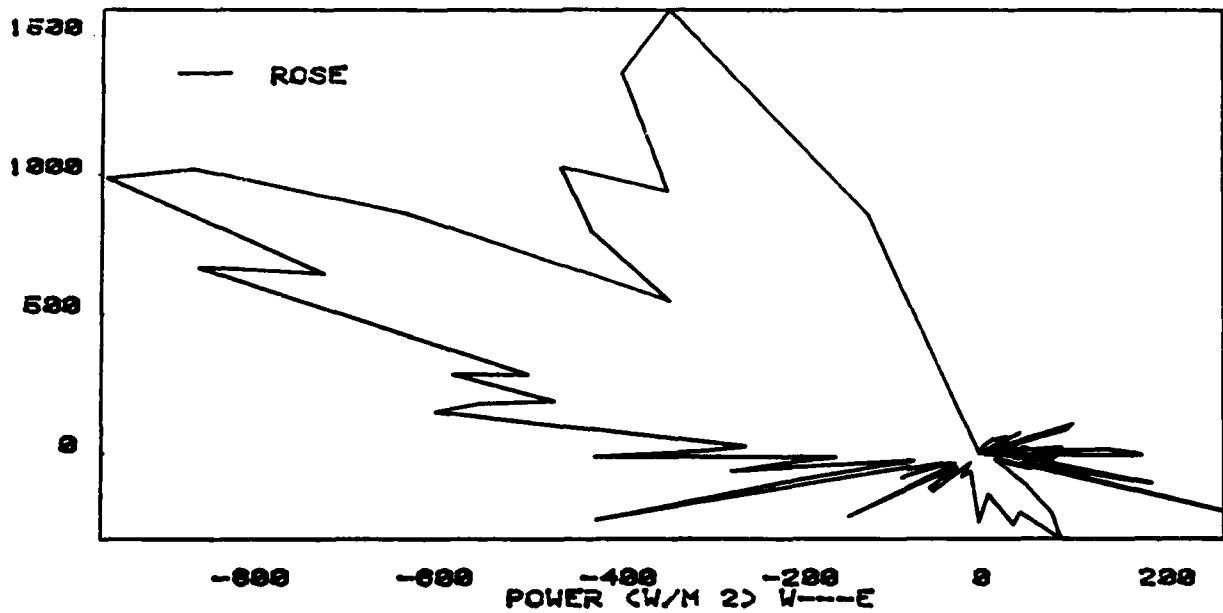
WIND ROSE-- MOOSE MT
7/29/80 - 5/27/81



MT WILDCAT
8/ 6/80 - 3/12/80



WIND ROSE-- MT WILDCAT
8/ 6/80 - 3/12/80



CHAPTER 6. LEGAL-INSTITUTIONAL ISSUES

6.1 INTRODUCTION

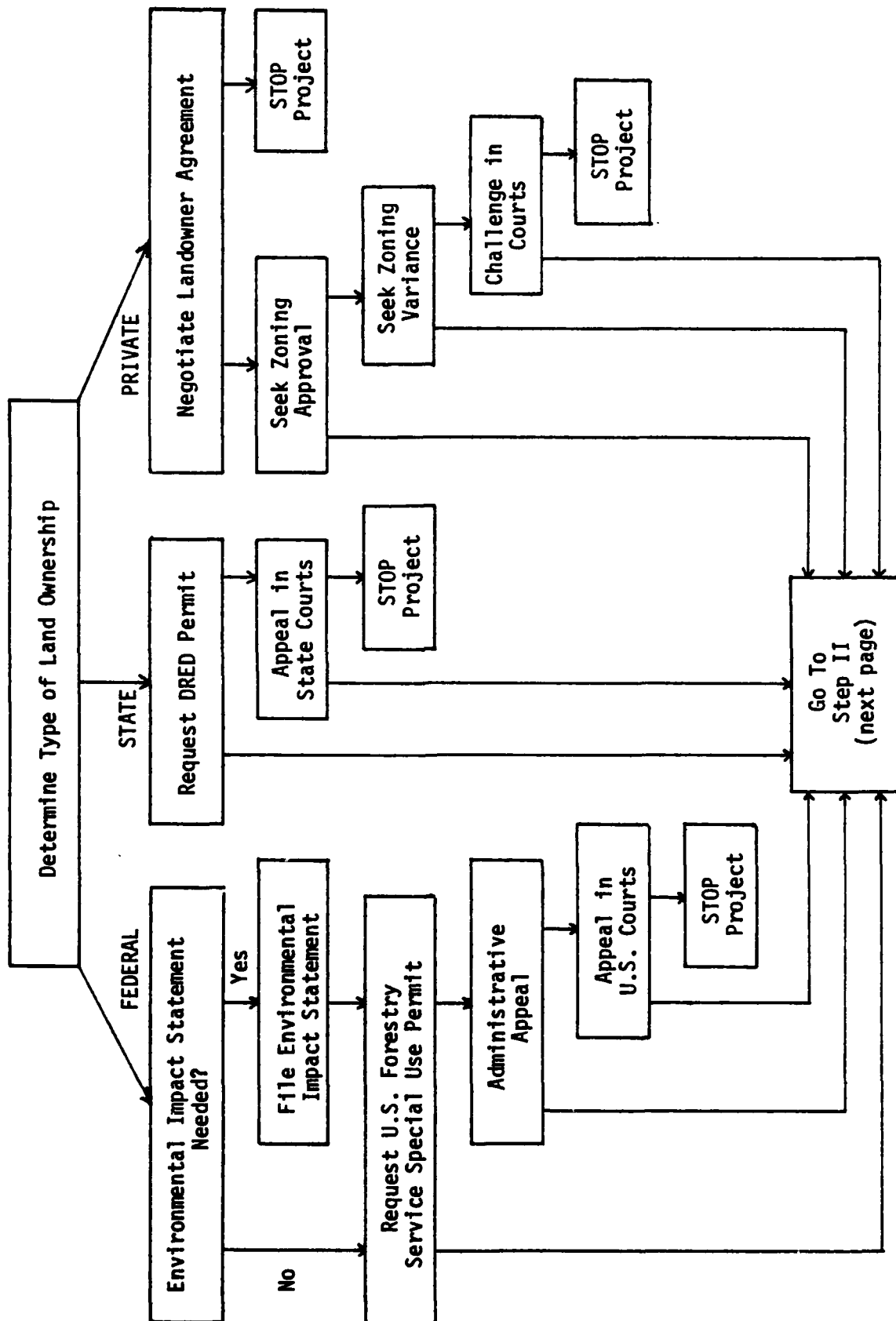
This section explores in detail the legal and institutional obstacles to the development of large-scale wind energy conversion systems (WECS) in the State of New Hampshire. It is intended to serve as an overview of the barriers facing a developer in New Hampshire. The study is the initial portion of the work completed for the University of New Hampshire (UNH) which has undertaken to perform an overall study for the Department of the Navy. Subsequent sections will analyze the legal and institutional obstacles to the development of WECS as they pertain to specific sites selected by the Mount Washington Observatory pursuant to its subcontract with the University of New Hampshire.

This study is important because the legal and institutional obstacles may, in fact, prove to be the most significant barriers to development. It need hardly be stated that the disregard of potential institutional barriers can certainly defeat an otherwise technically feasible project.

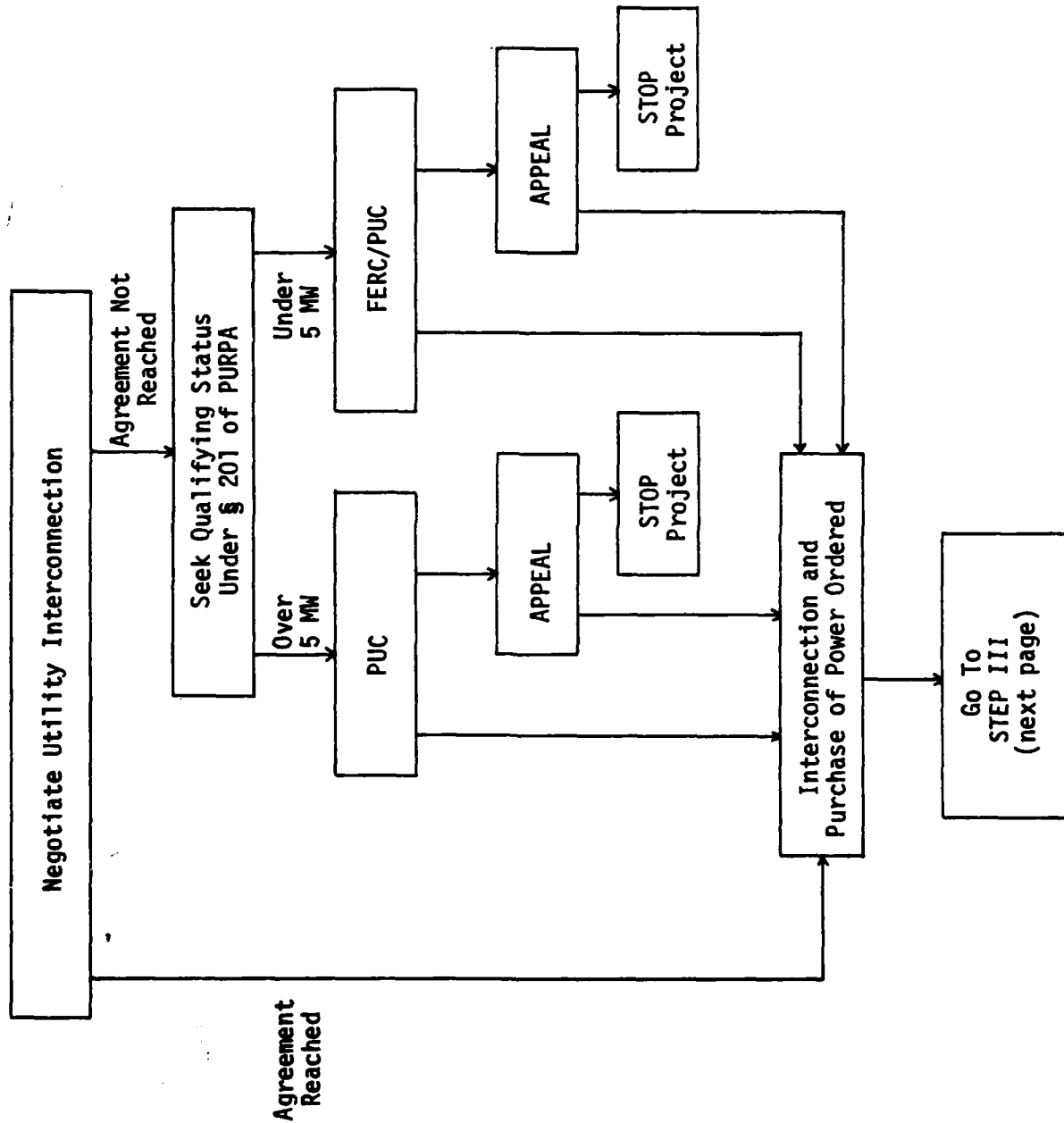
The analysis of those legal and institutional obstacles is presented here in the chronology, more or less, in which they will present themselves to a developer. Initially, a developer must secure the right to use a site for a WECS. Thus, the land use issues are the first to be addressed. Once a site is identified, a developer must examine the potential environmental impact of a WECS upon that particular site. Accordingly, this section will analyze the environmental barriers that may present themselves. A corollary issue that has faced WECS developers in the past has involved the question of WECS interference with certain broadcast signals. Such interference is discussed in its environmental context in the environmental section of this report. The probable regulatory barrier to the interference is addressed in the next section. Finally, a developer must consider how his WECS-generated electricity will be utilized. A complete discussion of the regulatory framework for marketing and an economic analysis has therefore been presented as the last major section of this study.

6.2 FLOW DIAGRAM

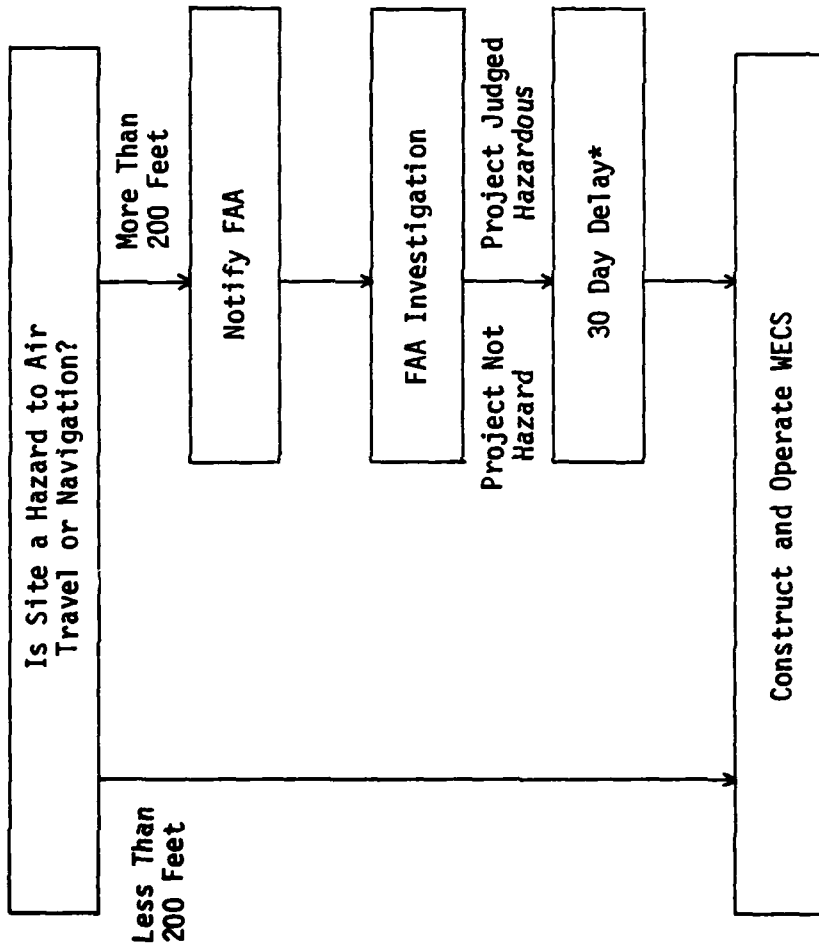
STEP I



STEP II



STEP III



* FAA can not legally stop project even if judged to be hazardous. Thirty-day warning is required before construction.

6.3 LAND USE ISSUES

An initial question facing a WECS developer is the choice of the site where the project will be located. Once a site is selected, the developer must secure the necessary rights to the use of the land. This section will deal with the land use issues which must be addressed by a WECS developer. For these purposes, land use issues consist of those legal and institutional policies which govern the development of a particular piece of land. The related environmental questions will be addressed in a separate section.

This study has been undertaken with a particular type of proposal in mind. It has been assumed that the developer wishes to construct a MOD 2; a WECS with a tower of approximately 200 feet in height and generating capabilities of 2.5 megawatts. Many of the following issues would arise from any WECS developer. Other issues arise only for a project of this size. FAA regulations, for example, are involved because of the tower height. Laws and regulations will be examined at the federal, state and local levels. The relationship between these laws will be analyzed to determine which laws apply in which circumstances.

This analysis of land use issues is founded on the assumption that the WECS developer will neither desire nor need to exercise the power of eminent domain. It appears possible to construct and maintain a WECS without upsetting existing ownership arrangements. This can be accomplished by permit on federal lands and easements and leases on other property.

The first step to sorting out the legal and institutional obstacles pertaining to land use for WECS development is to determine who owns the land. Classification of landholdings into federal, state and private ownership permits a systematic analysis of legal ramifications inherent in each type of landholding.

A. Federally Owned Lands

It is a well-settled principle of constitutional law that the supreme power is vested in the federal government.¹ This supremacy is limited by the concept of federalism so that the states may exercise sovereign power within their domain. Where state power conflicts with federal power the federal power is supreme if the federal government is acting within the sphere of its authority.² Federal

lands located within state boundaries are certainly within the sphere of authority of the federal government.³ Therefore the source of law governing the use of these lands will be federal.

1. Structure of federal Land Management

The federal government, through the Congress, has delegated the management of federal lands to certain management agencies. These agencies consist of the U.S. Park Service, the Bureau of Land Management (BLM), the Fish and Wildlife Service and the United States Forest Service. Congress controls the policies of these agencies with general and specific legislation. The general legislation is intended to influence policies across agency lines. This legislation ensures, for example, that environmental considerations will not be ignored.⁴ More specific legislation establishes objectives that direct agency behavior. The Interior Department, for example, is directed in part by the legislation which established national parks and national monuments, thus limiting or precluding development of these lands.⁵ A different philosophy prevails regarding lands controlled by the United States Forest Service of the Department of Agriculture. Forest Service lands are managed to provide maximum utilization of the available resources without depletion. This intensive land use is accomplished by balancing competing interests. In New Hampshire, the Forest Service appears to be the only federal management agency controlling relevant lands. Forest Service management decisions are guided by the National Forest Management Act (NFMA),⁶ the National Environmental Policy Act (NEPA)⁷ and increasingly by the Federal Land Policy Management Act (FLPMA).⁸ Guidance is obtained through the Forest Service Manual which incorporates these, as well as forty-six less relevant statutes and the specific regulations promulgated pursuant to the statutes, as well as the changes publicized in the Federal Register.

The NFMA was enacted to create a paradigm for resource assessment and planning efforts.⁹ In doing this, NFMA made references to the other acts which direct Forest Service policy. Notable among these acts was the Multiple-Use and Sustained Yield Act of 1960.¹⁰ These acts establish the Forest Service policy of intensive land use without depletion. A second function of NFMA is to

restrict allowable uses of National Forest System Lands to those uses which are consistent with the land management plans.

Principles for land use management were refined and further specified by the Federal Land Policy Management Act (FLPMA).¹¹ This law was enacted on October 21, 1976. The act was originally conceived as an organic act for the Bureau of Land Management. Prior to enactment, however, its language was expanded so that its effects cross agency lines. It expresses the desired policies of, among other things, multiple uses and sustained yield management, preservation of scientific, scenic, environmental and other values, and uniformity in acquisition, exchange and disposal of federal lands.¹²

Most of the changes following this act will require adjustments in rules in the interest of uniformity with other agencies managing federal land. A significant change in the rules regarding special use permits has been proposed due to the influence of this act. This change will be discussed in later sections of this report.

The National Environmental Policy Act (NEPA) also plays a significant role in directing Forest Service policies and in limiting its authority. Those effects are examined in the section of this report which analyzes environmental questions for the WECS developer.

A standard feature of these statutes is the grant to the Forest Service of authority to promulgate regulations for implementation of the desired policies. These regulations establish specific standards and procedures which have the force of law.

In turn, statutes and regulations are incorporated into the Forest Service Manual. This manual is the document on which the Forest Service officials rely in their day-to-day decision making processes.

Management decisions are made pursuant to these statutes, regulations and guidelines at two levels. The broad level yields a management plan for the forest and its constituent units. This planning is accomplished by presenting the public with management options and soliciting comments. Utilizing public participation, a management plan is hammered out. The creation of this plan

imposes another layer of control on the decision-making process at the specific level. In deciding whether or not to permit National Forest lands to be used for WECS units, not only will the officials be bound by all applicable federal laws and regulations, they will be required to maintain consistency with the publicized management objectives.

2. Land Use Authority

The Secretary of Agriculture is restricted by FLPMA in permitting federal departments and agencies to use, occupy, and develop public lands only through rights-of-way, withdrawals, and cooperative agreements.¹³ In addition, the Secretary is authorized to allow certain uses of National Forest Lands by private developers. This authority is derived from FLPMA which states in part:

The Secretary of Agriculture is authorized under such regulations as he may make and upon such terms and conditions as he may deem proper. . . (c) to permit the use of suitable areas of land within the National Forest, not exceeding eighty acres, and for periods not exceeding thirty years for the purpose of constructing or maintaining buildings, structures, and facilities for industrial or commercial purposes whenever such use is related to or consistent with other uses on the National Forest.¹⁴

This use is restricted in that it: ". . . shall be exercised in such manner as not to preclude the general public from full enjoyment of the natural, scenic, recreational and other aspects of the national forests."¹⁵

Current Forest Service regulations require a special use permit for all uses with some exceptions.¹⁶ Exempted are timber disposal, grazing of livestock, and other uses specifically authorized by Congress. These exemptions will remain intact despite the upheaval in the regulations necessitated by FLPMA.¹⁷

3. Obtaining the Right to Use Federal Land

The applicant for a permit will require permission for two separate functions. First, he will require the use of land on which to site a WECS. Second, he will require a right-of-way to transmit the energy away. However, it appears possible to get permission for both functions in a single permit. The concept of right-of-way has been so broadly interpreted that it need

not imply a linear concept. This broad conception of right-of-way will allow the right-of-way to include all of the incidental land needed for siting a WECS. The holder of a permit is granted:

. . . a special use authorization which provides permission, without conveying an interest in land, to occupy and use National Forest System land for specified purposes, and which is revocable at the discretion of the authorized officer.¹⁸

However, a subsequent section on termination, provides that permittees may request administrative review of decisions giving notice of termination or suspension.¹⁹

A WECS developer may also seek an easement for the right-of-way he will require. An easement is defined as:

Authorization for a nonexclusive right of use for a specified facility and purpose which conveys a conditioned interest in National Forest System land and which is revocable for abandonment or noncompliance only after an administrative proceeding pursuant to 5 U.S.C. Section 554.²⁰

Obviously, the holder of an easement has an interest which is more difficult to revoke. Other things being equal, a developer making a substantial investment in equipment would be well advised to seek such authorization.

Other things, of course, are not equal. Although it is more desirable, an easement under current regulations is much more difficult to obtain. Only the Chief or the Acting Chief of the Forest Service has statutory authorization to grant or modify easements. The failure of the regulations to delegate this power to the forest or district level indicates that the granting of an easement is not a matter to be taken lightly. The Chief, or Acting Chief, is also the official who decides which conditions should be incorporated in the easement.²¹

While authority for the granting of an easement has been extremely limited, the authority to issue permits has been broadly delegated. The Forest Service has been organized in such a way that officials at the forest and district levels may be active in negotiating terms and conditions of a special use permit. The District Ranger has been presumed to know how to integrate proposed uses with the management plan of his district. The authority of the District Rangers

is limited, however. For example, an application for transmission facilities of 66 KV or more must comply with the same conditions as are required for an easement.

The conclusion that follows is that a WECS developer today would probably be forced to obtain authorization via a permit, rather than an easement.

The proposed regulations promulgated pursuant to FLPMA may change this conclusion. In an effort to develop a common system for granting rights-of-way with the Bureau of Land Management (BLM), the Forest Service is proposing revocations of portions of the existing procedures and the substitution of a new set of regulations entitled Special Uses.²² In fact, the Forest Service appears to be anticipating the changes. In view of the existence of the proposed revision of the regulations the Forest Service has issued an interim directive which states flatly, "no final or long-term documents for rights-of-way shall be issued without authorization from the Washington Office. . . The authorization of new rights-of-way may be authorized on a temporary basis and in accord with current procedures. Only terminable permits will be issued."²³

The Washington Office stated that the new policy is to try to recognize the vested rights of developers by the granting of easements. This change in policy has not yet been incorporated into the Forest Service Manual. The Forest Service's local office therefore has not recognized this shift in policy and still believes that the issuance of a special use permit is the proper authorization for a proposal of this nature.²⁴

The regulations proposed by the Forest Service change the heading of the section of the current regulations titled "Rights-of-way for Electric Power Transmission Lines", to "Special Uses."²⁵ The proposed rules authorize the use of Forest Service land pursuant to FLPMA. Specifically, the Chief of the Forest Service or his delegated representative may issue permits, term permits, leases and easements. Under these proposed rules authorization may be obtained for ". . . systems for generation, transmission, and distribution of electric energy, except that the applicant shall also comply with all applicable requirements of the Federal Energy Regulatory Commission."²⁶ These requirements will be discussed in later sections.

a. Procedure for Obtaining the Right to Use Federal Land (Current Rules)

The currently effective rules regarding rights-of-way do not explicitly distinguish between authorization of land use by permit and authorization by easement. For this reason, one may assume that the conditions which need to be met may be the same for both types of authorization. However, because a good deal of discretionary power has been delegated to the forest level, it is also possible that the District Ranger or Forest Supervisor who reviews an application for a permit will not require all of the specified information in an application. Compliance with all of the specified conditions must be shown in applications for easements and applications for transmission facilities of 66 KV or higher.²⁷

The Forest Service has specified the exact procedure to be followed in an application for an easement.²⁸ These procedures require submission of a map of the proposal which establishes location by means of a survey. A second map diagramming the relationship with the power grid may be required. In addition, the Forest Service requires information which establishes the identity of the applicant.

The rules also dictate that the grantee shall pay such reasonable charges for the easement or permit as may be specified by the Chief.²⁹ However, they also authorize the Forest Service to issue easements or permits without charge when the use is: "(a) by a government agency, (b) of a public or semi-public nature, (c) for noncommercial purposes, (d) in connection with an authorized utilization of national forest resources, (e) of benefit to the Government in the administration of the national forests or for similar purposes compatible with the public interest, and when authorized and directed so to be issued by acts of Congress."³⁰

b. Procedure for Obtaining the Right to Use Federal Land (Proposed Rules)

Prior to application, a proponent is encouraged to contact the Forest Service Office responsible for the affected land for guidance, information and tentative scheduling of processing.³¹ The application itself must be filed with the District Ranger or Forest Supervisor and shall include: (1) identification (2) a statement of technical and financial capability;

(3) a description of the project; (4) an environmental protection plan; and (5) any other information requested by the authorized officer.³²

The rules which establish fees for use require that the fees be set at the fair market value of the rights and privileges, as determined by appraisal or other sound business practices. However, federal, state, and local government agencies may qualify for lesser charges, including free use if such use is equitable and in the public interest.³³

One of the more significant changes FLPMA makes is the section allowing the Secretaries of Interior and Agriculture to require applications for use to be accompanied by a deposit to reimburse the United States for reasonable costs with respect to that application. Reasonable costs have been defined to include, but not to be limited to: the costs of special studies, environmental impact statements, monitoring construction, operation, maintenance, and termination of any authorized facility.³⁴ Despite the apparent authority to do so, the Secretary of Agriculture has not proposed changes for applications regarding Forest Service land.

c. Evaluation of Applications

In considering whether to approve or deny any application, the Forest Service will be required to evaluate whether there will be compliance with other applicable laws. For example, the NEPA requires that a certain procedure be followed.³⁵ The Forest Service is also required to ensure compliance with applicable regulations of the Federal Energy Regulatory Commission (FERC). The original licensing authority of the Federal Power Commission (FPC), now the FERC, extended only to hydroelectric lines. Although the Public Utility Holding Company Act of 1935 amended the original 1920 Federal Water Power Act by adding sections dealing with the regulation of electrical utility companies, it did not have the effect of expanding the Commission's licensing authority.³⁶ Therefore, wind powered devices would not be included by implication. This has been confirmed by judicial interpretation where it has been ruled that the licensing power is only applicable to hydroelectric plants and ancillary facilities.³⁷ In addition WECS units could fall outside the jurisdiction of FERC because of the provisions excluding jurisdiction over generating facilities and transmitting facilities used in local distribution only and facilities generating power

consumed wholly by the transmitter.³⁸ Based on the foregoing analysis, one can conclude that FERC would not have jurisdiction over WECS siting.

A separate question is whether FERC has jurisdiction over the electricity entering the grid. If the developer is an agency, authority, instrumentality or political subdivision of the United States such as the U.S. Navy or a state, the provisions of the Public Utility Holding Company Act do not apply.³⁹ FERC regulatory authority over certain interstate sales of electricity, which must be distinguished from its licensing authority, is discussed in Section IV. The Forest Service has retained the jurisdiction to issue permits for transmission lines tranversing Forest Service land where that jurisdiction has not been granted to the FERC by the Federal Power Act.⁴⁰ In the case of WECS units, because it appears that FERC will not be involved, it will be the Forest Service who will have the authority to issue permits or easements for the transmitting facilities. The Forest Service rules requiring compliance with FERC rules do not apply to applications for the right to use Forest Service land for such purposes.

The Forest Service will, of course, also determine whether the proposal will be in compliance with the policies and management plans governing the site.

d. Restrictions and Conditions

(1) Upon the Applicant

Under FLPMA, authority is granted to authorize use for periods not exceeding 30 years for areas not exceeding 80 acres for industrial or commercial structures.⁴¹ One may assume that this can be interpreted as the maximum length of time before a renewal will be required.

In addition, the Forest Service is required to refer applications for easements for transmission facilities with a capacity of 66 KV or higher to the Secretary of the Interior in order to determine the relationship between the proposed facility and the power marketing program of the United States. The applicant is also required to bear the cost of avoiding inductive or conductive interference.

In addition, applicants for transmitting facilities with a capacity in excess of 66 KV must execute a stipulation agreeing to a number of other conditions.⁴² Conditions are designed to give the Department of Energy

(DOE) the authority to make use of the excess capacity of the facilities. Additionally, DOE is to be granted the authority to increase the capacity of the transmitting facilities at their expense, should the need arise. Other stipulations that are required include provisions designed to make DOE use of private lines an equitable arrangement. These conditions require, among other things, adequate notice of changing power needs, reimbursement for the cost of transmitting power and a procedure for resolution of disputes.⁴³ It is unlikely that these rules will be applicable to a WECS developer because current wind machines will not require 66 KV transmission capacity.

Also, a procedure for transferring an easement is outlined.⁴⁴ Similar procedures are specified for cases of forfeiture,⁴⁵ abandonment,⁴⁶ breach⁴⁷ and modification.⁴⁸ A new provision will be added by the proposed rules. This new provision requires written acceptance of the easement by the applicant.

(2) Upon the Forest Service

Section 251.4 of the regulations describes in detail the procedure which binds Forest Service officials in disposing of materials. This includes removing timber, stone and so forth. Generally, these materials are sold to the highest bidder, with provisions for other just and reasonable methods of disposal.

B. Use of State Land for WECS Development

Of the 5,954,752 acres of land area in the State of New Hampshire, 137,686 or 2.4% are owned by the State. The management of this land is delegated among seventeen state agencies. Parcels of this land range in size from the .14 acre parcel controlled by the Department of Administration and Control to the 7,939 acre parcel at Bear Brook State Park managed by the Department of Resources and Economic Development (DRED).⁴⁹ Most of these seventeen agencies hold land which appears to be related to functions other than those of land management (e.g. the campus of UNH at Durham, State Prison grounds and Liquor Commission warehouses).

The only agency which appears to have landholdings of significance for the WECS developer (from a land use perspective) is the Department of Resources and Economic Development. The Director of Forests and Lands of this Department is the official who will be involved. New Hampshire law gives him authority, with

the approval of the Governor and Council, and under the supervision of the Commissioner, over all matters pertaining to the use of state forests, parks, and reservations.⁵⁰ Matters pertaining to recreation development, administration and maintenance are handled by the Division of Parks.⁵¹ Cooperation between these two divisions is statutorily required.⁵²

No specific statute has been discovered which authorizes use of state lands by individuals and government agencies, nor are there effective state rules and regulations authorizing land use, or describing the application procedure for use of these lands. However, an analogy can be drawn between use of lands for WECS and use of lands for radio and television antenna sites. For the latter there is a set of guidelines with regulatory effect.⁵³ Those guidelines contain a statement of policy which provides that applications will not be considered if they do not fall within a specified category.⁵⁴ However, the only category listed pertains to installations by nonpublic agencies. Since the guidelines also provide that permits will only be granted when the use is in the public interest, this could mean either that use by public agencies of public lands is per se in the public interest, or that different guidelines apply to public agencies.

These guidelines acknowledge land use by permit. Further, they require minimization of loss of aesthetic value, prohibit transfer of permits, require a termination clause, and a hold harmless clause. Also required is a plan or design of the installation, adherence to safety codes, provision for lightning protectors, approval to modify the installation, and a showing of the applicant's ability to maintain the installation. Finally, the guidelines provide for imposing a fee for use by private owners.

It cannot be said with certainty whether these guidelines or others will be applicable in the case of a WECS. However, it is likely that where similarities exist between a WECS and a radio or television antenna, DRED will apply similar standards.

The type of proposal being contemplated seems to have prompted DRED response. Because criteria for decision-making do not exist, a committee has been formed. This committee is composed of the Supervisor of the Forest Fire Service, the

Assistant Supervisor of Parks and the DRED Engineer. The formation of this committee at this time leads one to believe that its function will be to deal with specific proposals on an ad hoc basis rather than formulate policy. In considering each proposal, the committee will assess the environmental and aesthetic consequences of the proposal with some consideration given to the potential benefit.⁵⁵

C. Use of Private Land for WECS Development

A WECS developer who chooses to site facilities on private land owned by another must negotiate a satisfactory agreement with the landowner. Land ownership carries with it the right to dictate how that land will be used. Without question, the landowner has the right to allow others to make use of his land, consistent with all applicable laws and regulations. However, he also has the power to impose restrictions on the use of that land without reason. It is therefore advisable that each party be made aware of the extent of his rights before commencing development.

In addition to these restrictions the owner's interest may be less than total (i.e. he may not hold in fee simple). There is the possibility of restrictions on the use of private property arising from covenants, easements, and the like. All of these issues must be resolved on a case-by-case basis through an examination of the title of the property.

Even if a satisfactory agreement is negotiated with the landowner, the state or municipality could impose restrictions on the use of the land. This is generally accomplished through zoning, the creation of historic districts, or the creation of town forests.

1. Zoning

Perhaps the most difficult barrier to the development of WECS on private land is the power of cities, towns, and villages to enact zoning ordinances. Generally zoning laws divide the land in the jurisdiction into several use districts. The goal is to separate incompatible uses; for example, to protect the quality of residential areas by keeping factories out. Typical use categories found in zoning ordinances are (from least to most restrictive) residential single family

dwellings, residential multi-family dwellings, commercial and industrial. Usually the restrictions are cumulative also. That is, single family dwellings are allowed in commercial areas, and all uses are allowed in industrial areas. One must read the local ordinance to determine which uses are allowed in each area, but it seems likely that large-scale WECS would be restricted to industrial areas.

The local power to enact such restrictions is delegated by the state. In most cases zoning is considered a proper policy power which the states can delegate to local governments. It does not involve a taking of private property; it only limits the activities one may engage in on one's property.⁵⁶ In order for a local ordinance to be valid it must conform to the state's authorization. In New Hampshire, local governments may enact ordinances to protect the health, safety, morals, or general welfare of the people.⁵⁷ The State Zoning Enabling Law also requires that all zoning be based on and be in conformance with local comprehensive planning.⁵⁹ Finally, the state law establishes specific notice, hearing, and appeal procedures which must be followed when a local government enacts a zoning ordinance.⁶⁰

Zoning can effectively prohibit WECS development but a developer should not abandon a favorable site without doing further investigation. If sites in New Hampshire do fall under local zoning law the likelihood is that the zoning will not allow large-scale WECS development; however, other remedies remain open to the developer.

First, the constitutionality of the law may be challenged on one of two grounds. The law could have been adopted by a defective procedure or it could place some restriction on the property which is not a legitimate exercise of the policy power. This would amount to a taking in contravention of the United States⁶¹ and New Hampshire constitutions.⁶² A challenge of this nature is unlikely to succeed, however, as most zoning ordinances are upheld.⁶³

Secondly, a developer with land in an unfavorable zone can petition the local government for a rezoning. The process by which this could be done would be a zoning amendment and the procedures outlined in state law must be followed.⁶⁴ It is interesting to note, however, that local voters can mandate that a proposed zoning amendment be submitted to a vote of the local legislative body. A petition

signed by twenty-five voters is all that is needed to put the amendment to a vote.⁶⁵ This type of zoning may favor one owner specifically because the vote generally arises when one owner wishes to amend the zoning law as it pertains to his particular land. Such an amendment may be challenged on the grounds that it is illegal spot zoning. Zoning laws must be in the public interest rather than one landowner's interest. But the New Hampshire Supreme Court has held that "[T]he mere fact that the amendment zoned in a small area at the request of single owner does not of itself make the result spot zoning."⁶⁶ The amendment can survive a spot zoning challenge if it is based on some public need or is justified under the general welfare clause of the enabling act. But an amendment clearly contrary to a comprehensive plan will be difficult to justify in this way.⁶⁷

One other route remains open for the developer with a zoning conflict, and it is the path which will most likely be successful. An essential part of each zoning ordinance is the provision for a board of adjustment which is empowered to grant zoning variances.⁶⁸ In Rochester Zoning Board of Adjustment v. Alcoru⁶⁹ the New Hampshire Supreme Court outlined the circumstances in which a board of adjustment should grant a variance. A variance may be granted when: (1) it would not result in diminishing neighboring land values; (2) granting of the variance would be in the public interest; (3) denying the variance would cast an unnecessary hardship on the owner; (4) substantial justice will be done by granting the permit; and (5) the proposed use would not violate the spirit of the zoning ordinance. The unnecessary hardship clause has been judicially interpreted to be a hardship which is ". . . suffered by the defendant as the result of the interference with its right to use its property as it sees fit. . ."⁷⁰ In addition, a further requirement must be fulfilled before a zoning variance will be granted. The need for the variance must be based on some special characteristic of the land. The zoning ordinance is necessarily a burden on all land holders. The owner seeking a variance must suffer a specific burden because of some unique aspect of his or her land.⁷¹

The outcome of a petition for a variance looks very promising for a WECS developer provided that: (1) the placement of a machine would not diminish abutting land values and (2) that WECS use would not severely violate the spirit

of the zoning law. Clearly it can be shown that WECS development is in the public interest and that the quality of the land is unique in that it has a favorable wind regime.

In the event of an unfavorable ruling by a board of adjustment, appeals may be taken to the Superior Court.⁷² The Court will generally hear only questions of law, however, and accept the facts found by the board of adjustment unless they are unreasonable.⁷³

Lastly, many towns and villages in New Hampshire have no zoning ordinances. But the developer should be aware that the state has enacted a law which provides for an emergency interim zoning procedure.⁷⁴ A developer contemplating a site may find no zoning controls one week and be faced with a complete zoning ordinance the next. This is an unlikely danger, but nevertheless, a danger of which one should be aware.

A zoning ordinance can effectively prohibit WECS development; but developers should not resign their plans in the face of such an ordinance. The ordinance can be overcome by several different methods though each approach will add certain costs to the total project. Fortunately for WECS developers, most of the best sites will be in remote parts of the state where zoning ordinances do not yet exist.

2. Other Restrictions

Another type of power granted to cities and towns is the authority to create historic districts.⁷⁵ This power is intended to protect structures of historic and architectural value.⁷⁶ It is unlikely that this power will have any effect on WECS development because the wind machines will probably be located in remote areas where there are no existing structures to protect.

The grant of power to establish city and town forests is more likely to have an effect on WECS developers.⁷⁷ City and town forests are discussed in this section on the use of private land for WECS development for two reasons. First, city and town forests are not managed by the state. Second, because WECS units are expected to be located in remote areas which may be choice sites for a city or town forest, the developer should be aware that municipalities in New Hampshire have the power to acquire land for these purposes. This power to acquire land

for town forests does not include the power of eminent domain.⁷⁸ It seems possible, therefore, for the WECS developer to incorporate sufficient terms in his lease or easement to prevent loss of the site to a municipal forest. If the proposed site is already located on a municipal forest, permission for use of the land may be granted by the town forestry committee. This committee is composed of three to five individuals, including the town tree warden, if there is one, who are appointed for three-year terms by the mayor and aldermen.⁸⁰ These members serve without compensation.⁸¹ The committee is to be assisted in its duties by the Director of Forests and Lands of DRED.⁸² Because the committee is an amateur management agency, and because the DRED Division of Forests and Lands is intimately involved, one can expect that the management and application process for the use of municipal forests will be very similar to that used for state forests.

D. Other Considerations

1. Aviation

Notice of construction of structures in excess of 200 feet in height is required by the Federal Aviation Administration (FAA).⁸³ This same regulation requires supplemental notice 48 hours prior to construction, and again within five days of completion. This notice requirement may be avoided if: (1) the object to be constructed is shielded by natural terrain features of equal or greater height; and (2) there is no doubt that the object would not adversely affect air navigation.⁸⁴ In the case of WECS units, neither of these requirements would be met because these units would probably be designed with maximum exposure, thereby creating an obvious danger to aircraft. For these reasons, it is likely that notice must be given to the FAA.

It is possible, though not probable, that a WECS unit could be classified as an obstruction. An obstruction is defined as an object taller than 500 feet or an object 200 feet in height which is within three nautical miles of an airport.⁸⁵

In either case, notice must be given to the FAA by sending four copies of a form 30 days before beginning construction, or 30 days before an application for a construction permit is filed.⁸⁶ Projects subject to the Federal Communications Act may send applications simultaneously to the FCC and FAA. Upon receiving

notice, the FAA commences an aeronautical study which includes an investigation of the physical and electromagnetic effect of the proposal on aviation.⁸⁷ To the extent considered necessary, the FAA may also: (1) solicit comments; (2) explore objections; (3) examine possible revisions; and (4) convene a meeting of interested persons. At the conclusions of this process, it is determined whether the proposal poses a hazard to air navigation. This determination is considered final unless the Administrator, at his discretion, grants a review.⁸⁸

This determination however, is of little consequence. The FAA itself has argued that a determination of "hazard" or "no hazard" has no enforceable effect.⁸⁹ This determination, according to the FAA, carries only the power of "moral suasion".⁹⁰

The State Aeronautics Commission is also empowered to issue rules, regulations and orders where necessary. These rules shall require notice of construction or alteration "where such notice will promote safety in air navigation."⁹¹ However, this Commission does not have any effective rules at this time. Regulation of tall structures, therefore, appears to be accomplished through the provisions of the statute with some reliance on local zoning ordinances. The statute itself prohibits the construction of any structure over five hundred feet above the highest point of land within a one mile radius from the structure. Even on a mountain top a WECS unit, as planned, would not require a permit. An exception to this generalization could arise if the proposed structure is within the slope ratios for airport approaches.⁹²

2. Regulatory Requirements for Siting Energy Facilities

Bulk power supply facilities may not be constructed unless a certificate of site and facility has been issued.⁹³ Applications for such certificates are reviewed by the New Hampshire Site Evaluation Committee.⁹⁴ It is unlikely that this requirement would be applicable to a WECS developer. This is because bulk power supply facilities are defined by the statute as generating stations with a capacity of at least 50 MW or certain transmission lines with an operating voltage of at least 100 KV.⁹⁵ WECS with that level of capacity do not exist and will probably not be developed in the foreseeable future.

The fact that WECS do not fall within the definition of bulk power supply facilities raises a question of whether a developer would be subject to the jurisdiction of the Energy Facility Evaluation Committee (EFEC). No energy facility may be constructed without a permit from the EFEC.⁹⁶ The question of EFEC jurisdiction will depend upon the applicability of the statutory definition of energy facility to a WECS.

Energy facilities are defined as:

. . . any industrial structure, other than bulk power supply facilities as defined in RSA 162-F:2, that may be used substantially to extract, manufacture, or refine sources of energy, and means also such ancillary facilities as may be used or useful in transporting, storing or otherwise providing for the raw materials or products of any such industrial structure; without limiting the generality of the foregoing, such ancillary facilities include onshore and offshore loading and unloading facilities, pipelines and storage tanks.⁹⁷ (emphasis supplied)

Although this provision appears broad, its application would probably be restricted by the general rules of statutory construction. Those rules involve general principles of ascertaining the intent of the legislature.

Generally, legislative intent is not examined unless an ambiguity exists. In the definition of energy facility the question of ambiguity is raised by the limitation to industrial facilities which ". . . extract, manufacture, or refine sources of energy." If a WECS can be viewed as a structure which manufactures energy rather than a source of energy, such as oil, the definition is clearly not applicable and no ambiguity exists. However, if the term "source of energy" can be read as applying to the WECS itself, the wording could be viewed as ambiguous and the legislative intent must be ascertained.

In construing legislative intent two statutes must generally be read to be consistent with one another, if such a reading is not illogical. The two applicable statutes are the definition of "energy facility" and the definition of "bulk power supply facility" which is specifically referenced in the "energy facility" definition. The legislature explicitly excluded electric generating facilities with a capacity of less than 50 MW from the definition of "bulk power supply facility."⁹⁸ In so doing, the legislature made the obvious judgement that it is the larger generating facilities that should be subject to regulation.

It would be illogical to subject smaller, excluded facilities to the same regulation through another statute, particularly in view of the fact that the Site Evaluation Committee and the EFEC are comprised of the same members.⁹⁹ The better construction would give weight to the legislative intent to exempt small electrical generating facilities from siting regulation.

Another general rule of statutory construction requires that where specific words follow general words, the general words are limited to things similar to the specific words.¹⁰⁰ The examples in the definition of "energy facility" all involve processes which change the form of a resource. The final product of the specified processes is a source of energy. Since a WECS does not change the form of a resource into a source of energy, but rather produces energy directly from the wind, it would fall outside the specific examples and, accordingly, could not be viewed as falling within the general language of the definition.

It can therefore be concluded that the EFEC does not have jurisdiction over a WECS. If the statute is unambiguous, its terms clearly do not apply to wind machines. If the terms are ambiguous they must be read as being consistent with the legislative intent inherent in the definition of "bulk power supply facility" and as restricted by the specific examples in the statute. Such a reading would also have the effect of excluding WECS. Caution is advised, however, since this interpretation has not yet been examined by the courts.¹⁰¹

II. ENVIRONMENTAL ISSUES

A. Introduction

Environmental legislation has proliferated at both the state and federal levels over the past twenty years. These laws were divided into three categories for this study: the National Environmental Policy Act, laws regulating environmental pollution, and those designed to protect and preserve the natural environment. These laws either directly govern private development or the federal or state government's participation in the development of wind energy conversion systems. For this reason it is important for developers to have an understanding of this area of law.

B. The Act

The National Environmental Policy Act of 1969 (NEPA)¹⁰² does not guarantee that the environment will be protected. Although often thought of as a tool for

environmentalists, the act by itself does not directly operate to preserve or enhance environmental amenities. Rather, it only ensures that environmental factors will be taken into consideration by federal agencies when they are making decisions. NEPA is truly a procedural act as it designates a decision-making process which federal agencies must use. The NEPA theory is that if governmental agencies are required to consider the environmental effects of their actions before decisions are made, then the programs and policies finally adopted will be those with the least adverse impact on the environment.

Section 101¹⁰³ of the act is a general statement of Congressional policy. The Congress recognized man's impact on the environment and the responsibility of all to act as trustees of our environment.

The major operative section of NEPA is section 102¹⁰⁴ which provides that all federal agencies shall: (1) utilize the natural and social sciences in an interdisciplinary approach to planning and decision-making processes; (2) work in consultation with the Council on Environmental Quality to develop methods by which environmental values can be incorporated in decision making; (3) study alternative uses of available resources when making decisions; and (4) cooperate at the international as well as state and local levels in efforts to prevent the degradation of the environment. The most famous and concrete clause in this section is § 102(C)¹⁰⁵ which provides that federal agencies shall:

. . . include in every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on --

- (i) the environmental impact of the proposed action,
- (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,
- (iii) alternatives to the proposed action,
- (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
- (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Prior to making any detailed statement, the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved . . .

This section of NEPA has been litigated very heavily in efforts to define terms and responsibilities. Some important issues courts will decide when this statement, now referred to as an Environmental Impact Statement (EIS), is necessary, whether an EIS is sufficiently complete and whether parties had an opportunity to comment on a draft EIS. These issues will be discussed in more detail later in this report.

The Council on Environmental Quality (CEQ) was established by §§ 202-206 of NEPA.¹⁰⁶ The CEQ, in the Executive Office of the President, is charged with various information gathering and disseminating powers and duties. One of the most important of these is the power to review and make recommendations on the programs of the federal government.¹⁰⁷ Executive Order No. 11,514¹⁰⁸ granted the CEQ further authority to issue guidelines for use by the agencies when preparing EIS's as required by NEPA § 102(C).¹⁰⁹

The guidelines issued under this authority explained and defined the NEPA process more fully.¹¹⁰ They were not mandatory, however, since "guidelines", unlike "regulations", do not carry the force of law.¹¹¹ A new Executive Order has given the CEQ additional authority so that it may promulgate regulations which will govern agencies' use of the NEPA decision-making process.¹¹² Rules have been promulgated, effective July 30, 1979, which replace the old guidelines in the Code of Federal Regulations.¹¹³

1; The Regulations of the Council on Environmental Quality

The new CEQ regulations are very important. As much as possible, they seek to standardize agencies' decision-making processes in conformance with NEPA. The rules clearly designate and define the procedures to which agencies must now conform.

Although these rules impose requirements on federal agencies and not private developers, it is important that developers have some knowledge of the rules. If a developer seeks financial assistance, a permit, or a license from a federal agency, the agency will be required to utilize the NEPA decision-making procedures found in these rules. Furthermore, if litigation is initiated to challenge the developer's project, it will likely be based on the claim that the agency did not properly adhere to the NEPA and CEQ regulations.

The regulations state that the NEPA process shall be a part of agency planning and shall begin ". . . at the earliest possible time."¹¹⁴ Beginning the NEPA process means that the agency will use a ". . . systematic, interdisciplinary approach which will insure the integrated use of natural and social sciences and the environmental design arts . . ."¹¹⁵ to identify environmental effects, and to study and develop appropriate alternatives to a proposed action.¹¹⁶

CEQ regulations dictate that agencies must develop "specific criteria for, and identification of . . . typical classes of action . . ." undertaken by the agency.¹¹⁷ There are three classes into which actions may fall: (1) those which normally require an EIS, (2) those which may not require an EIS but do require more study in the form of an environmental assessment, and (3) those which may be "categorical exclusions," that is, neither an EIS nor an environmental assessment will normally be required.

The action's effect on the human environment will determine which classification is appropriate. The "categorical exclusion" is the class of actions ". . . which do not individually or cumulatively have a significant effect on the human environment . . ."¹¹⁸ At the other extreme, a full EIS is required by NEPA for that class of actions which "significantly affect the quality of the human environment . . ."¹¹⁹ An environmental assessment will be prepared for actions when it is not clear from the outset how significant the environmental impact will be.¹²⁰ The environmental assessment will then serve as a basis for the agency's decision on the need for a full EIS. The result of this decision will either be a "finding of no significant impact" (FONSI) or the preparation of a full EIS.¹²¹

Therefore, before an agency can successfully categorize its actions, it must determine whether the action is a ". . . major Federal action significantly affecting the quality of the human environment . . ."¹²² The meaning of those words has been the subject of many law suits. The analysis once began with the identification of "major Federal actions." Some courts held that if a major federal action was found a determination of the significance of the effect would follow.¹²³ Other courts held, however, that this analysis was improper. Rather, the important question was whether a federal action had a significant

impact. If it did, then it would be considered a major federal action.¹²⁴ This second method of analysis was adopted in the CEQ regulations where for NEPA purposes "major Federal action" is defined. "Major . . . has no meaning independent of significant."¹²⁵

There must, however, be a federal action before the NEPA requirements become applicable. Almost any decision a federal agency takes will be considered a federal action for purposes of the act. For example, adoption of funding plans, programs, or projects and the granting of licenses or permits are all federal actions.¹²⁶

The effect contemplated by NEPA must be on the "human environment." This term has been interpreted broadly to encompass the "natural and physical environment"¹²⁷ whether or not humans reside in the area. For example, logging in the Boundary Waters Canoe Area was held to affect the human environment even though no persons reside in that area because it is federally owned.¹²⁸ Effects on the environment include direct and indirect effects regardless of whether they appear distant in time or place as long as they are "reasonably foreseeable."¹²⁹ Effects which are ecological, cultural, economic, aesthetic, health related, or historic will be considered whether they are beneficial or detrimental.¹³⁰ Effects must also be significant in terms of their context, that is, the geographical setting or their intensity before an EIS will be required.¹³¹ The CEQ rules provide some methods of determining the significance of the effect. These include consideration of whether there will be an effect on public health, whether the nature of the impact is uncertain and risks are high and whether the effects are insignificant for this action but may produce a significant effect when coupled with the effects of other related actions.¹³² It is difficult to tell from the cases which actions will be construed to have significant impacts by the courts.¹³³ It appears that, when in doubt, agencies will often assume a significant impact and prepare an EIS in order to avoid litigating this question.

If an agency does decide to prepare an EIS, the EIS must meet certain requirements before it will be considered sufficient. These requirements are fully explained in the new CEQ rules.¹³⁴ The agency must document the action, the affected environment and the consequences of the action. In addition, it must document all reasonable alternatives to the proposed action, their environmental effects and all measures appropriate for mitigating the environmental impacts of each alternative.

Whether an agency declines to prepare an EIS or undertakes a full impact study, its decision, or its EIS, may face a legal challenge. Developers should understand how courts will review agency decisions. Courts have heard such questions as whether an agency made the proper decision when refusing to do an EIS or whether an agency took the proper action after the NEPA process was completed. When making these determinations courts will first decide which standard of review should be used.

Agency decisions must be based on some form of record. For example, an environmental assessment may be the basis of a finding of no significant impact. In general, administrative law only requires that an agency's decision not be "arbitrary and capricious," that is, that there be some basis for the decision in the record. This approach has been adopted by the Second and Seventh Circuit Courts of Appeal.¹³⁵ However, a distinct split of authority exists on this question. The Fifth, Eighth, and Tenth Circuits have imposed a different standard. It requires that courts closely examine the record to determine whether it reasonably supports the agency's decision.¹³⁶ Although the First Circuit Court of Appeals has not ruled on this issue, three District Courts in the First Circuit, including the New Hampshire District Court, have adopted the more stringent "reasonable basis in the record" standard of review.¹³⁷ One can safely assume that an agency's NEPA process decisions will be closely examined by all the Courts of the First Circuit.

The CEQ regulations deal with other topics of agency procedure that are also important. One is how agencies should cooperate when more than one agency is involved in the same project. In this case a lead agency shall be designated which will be responsible for the EIS.¹³⁸ Another area governed by the CEQ regulations involves avoiding delays and paperwork. Under these rules agencies are allowed to set time limits for various phases of the NEPA process¹³⁹ and set maximum page limits, within reason, for EIS's.¹⁴⁰ These limits should significantly reduce the expense and burden that EIS's often become. As a result, agencies may be more willing to perform EIS's in the future. A third topic governing agency procedure provides for public participation in decision making. During some phases of the process agencies may seek public comment before

decisions are finalized,¹⁴¹ but for other phases the agency must seek and respond to public comment.¹⁴² These requirements are important because failure to comply is grounds for invalidation of the agency action by a court.

The CEQ rules go far to end much of the confusion surrounding the NEPA process. Procedures and definitions are standardized for all agencies as much as practicable. No court decisions have challenged these regulations to date, but it is reasonable to expect that these rules will be given great deference by the courts so that agency decisions which comply fully with the CEQ rules will be upheld by the judiciary.

2. Other NEPA Regulations

The CEQ regulations mandate that all agencies adopt rules to supplement those regulations.¹⁴³ There are two agencies which may be involved in the development of wind power in New Hampshire: The Forest Service, a division of the Department of Agriculture, and the Navy, under the Department of Defense. Both departments have promulgated rules implementing NEPA¹⁴⁴ and the Forest Service has additional regulations which appear in the Forest Service Manual.¹⁴⁵ The involvement of these departments stems from the fact that the Navy has some interest in developing wind power and the Forest Service manages many of the sites that appear favorable for the development of wind power.

For the most part these regulations restate the CEQ regulations reviewed before in this section. In fact, the Department of Agriculture incorporates all the CEQ rules into its own by reference.¹⁴⁶ However, there are some regulations peculiar to each agency. These mostly pertain to categorical exclusions. For example, the Department of Defense regulations do not apply to combat or combat related activities.¹⁴⁷ The Department of Agriculture defines routine data collection, educational activities, and law enforcement activities as being categorical exclusions.¹⁴⁸ In addition, the specifics of agency procedure are found in these regulations. For example, the Forest Service has established time tables for the NEPA process depending on what type of action is being contemplated.¹⁴⁹ Therefore, if a wind energy developer is relying on some federal action to be undertaken by one of these agencies, he should be aware of the rules of procedure used by the agency in deciding whether to take that action.

3. State Environmental Policy Act

Many states also have environmental policy acts similar to NEPA; but at this time New Hampshire has no act requiring agencies to consider environmental impacts when making decisions.

4. The Environmental Impact of Wind Energy Conversion Systems

a. Introduction

If a private developer wishes to construct a large-scale wind energy conversion system (WECS) in the National Forest, the Forest Service will be required to use the NEPA process when deciding whether to grant or deny permission.

WECS do not have substantial environmental impacts but many questions concerning suspected impacts have not yet been fully answered. For this reason, an environmental assessment will most likely be undertaken at the outset and a full EIS may be required. At this time the Forest Service will discover the environmental impacts which WECS literature documents and hypothesizes.

b. Areas of No Likely Impact

There are many impacts which appear to be insignificant or non-existent. As WECS use no fuels or water and create no wastes, it can be assumed that there will be no air or water pollution impacts. Also limited experience with existing WECS indicates that they will cause no significant noise pollution.¹⁵⁰ Furthermore, it appears that the operation of a WECS will have very little effect on terrestrial wildlife¹⁵¹ and insects.¹⁵² Finally, WECS are not expected to have impacts upon historical sites or districts. If impacts are foreseen they can be mitigated by careful site selection.

c. Construction

There is the possibility that construction of a WECS would have more profound effects than operation. Environmental impacts might be noise and air pollution from the operation of construction equipment and possible soil erosion and subsequent water pollution from the clearing and excavation of land. Some necessary disturbance to wildlife habitats would also take place. In addition, these construction disturbances might be repeated many times as power lines must be constructed to deliver the electricity generated. Although environmental impacts would accompany WECS construction, these are not usually considered one of the "significant effects" on the environment contemplated by NEPA and some methods of mitigating the damage are available to the conscientious developer.

d. Aesthetics

There are a few impacts which may be so significant as to require the preparation of an EIS. Agencies are required to consider aesthetic impacts when making decisions.¹⁵³ Clearly the placement of a two hundred foot tower with a three hundred foot diameter rotor on a mountain top in a heavily used recreation area will have some aesthetic impact. To some extent this impact can be mitigated by design,¹⁵⁴ but one can only speculate at this time as to how significant this effect would be. Because of the personal nature of aesthetics, the courts hesitate to make a judgement. Instead, deference is given to the agency's aesthetic determination with little judicial scrutiny of the decision.¹⁵⁵

One way of identifying the aesthetic effect is by gauging the controversy generated. If a project is highly controversial an EIS will be required;¹⁵⁶ however, the controversy must result from a "substantial dispute." Opposition to the project is not enough.¹⁵⁷ Still, it seems quite likely that a substantial controversy could arise over a proposal to build a WECS in the White Mountains.

e. Migratory Birds

Not enough study has been done to adequately identify the effect that WECS operation could have on migratory birds. The studies completed indicate that because so many variables are involved, it is difficult to estimate the number of birds that will be killed by a collision with a WECS. These variables are the placement of WECS in relation to the Atlantic migration route, weather conditions, terrain, species, rotor design and speed.¹⁵⁸ Statistical studies conducted to date indicate that the number of birds killed should be "quite low."¹⁵⁹ Although experience with wind systems has not given much evidence of bird kills, experience with other structures indicates that major bird kills may occur every several years.¹⁶⁰

f. Broadcast Signals

Enough data exist to show that WECS can cause significant disruption of air wave transmissions; however, some of the effects can be mitigated by careful site selection. For example, the effects on microwave,¹⁶¹ VOR aircraft navigation,¹⁶² Automatic Directional Finding transmitters (aircraft),¹⁶³ Distance Measuring Equipment (aircraft),¹⁶⁴ and Tactical Air Navigation systems¹⁶⁵ can

all be avoided by careful site selection. WECS operation will impair FM reception if the receiver or transmitter is close to the wind machine,¹⁶⁶ but thoughtful siting can overcome this problem also. The major obstacle here is interference with television reception.¹⁶⁷ The zone of interference is determined by the angle between the transmitter, the WECS and the receiver. At some points in the interference range a directional antenna can overcome the wave scattering created by the WECS.¹⁶⁸ Apparently the amount of interference can also be mitigated by use of an optimum blade design and blade composition,¹⁶⁹ but the only way to definitely solve this problem is the installation of cable television. This was done when the Department of Energy decided to build a WECS on Block Island, R.I.¹⁷⁰

These effects are likely to be considered significant for NEPA purposes. If these effects can be mitigated by siting, introducing cable television, or using design options to minimize the aesthetic impact, and if bird kills prove to be insignificant, then a full EIS may be avoided. Still at least one of the first WECS built was accompanied by a full EIS.¹⁷¹ Perhaps after the effect of the technology is better understood, this type of study can be avoided.

EIS's, though expensive, will not be the time consuming and costly projects they once were. The new CEQ rules allow for page limits and time tables should result in considerable savings of time and money for the agencies, even when they must complete the most burdensome of NEPA requirements.¹⁷²

C. Pollution Problem and Abatement

1. Chemical Spraying

The operation of an energy facility usually necessitates maintenance of a transmission line right-of-way. Often this is accomplished by herbicide spraying. At the federal level, the Environmental Protection Agency (EPA) regulates the use of herbicides. New Hampshire enforces a set of statutes and regulations, which complement the federal law, through the Pesticide Control Board.

As the federal and state statutes are designed to achieve the same ends, they are very similar. Subchapter I of the Federal Insecticide, Fungicide, and Rodenticide Act¹⁷³ corresponds to the state's Economic Poisons Law.¹⁷⁴ These

two laws regulate the sale and labelling of economic poisons. Economic poison means "any substance . . . intended for use as a plant regulator, defoliant or dessicant."¹⁷⁵

Of more concern to energy developers is Subchapter II¹⁷⁶ of the federal act and the New Hampshire Pesticide Control Law.¹⁷⁷ The federal law classified pesticides (equivalent to economic poisons for these purposes)¹⁷⁸ into use categories¹⁷⁹ and then established a certification process for those wishing to use herbicides;¹⁸⁰ however, the federal program will yield to a state program of certifying herbicide users if the state plan meets federal requirements.¹⁸¹ The New Hampshire plan for the certification of herbicide users is, therefore, controlling. It is found in the Pesticide Control law, cited earlier in this section.

A WECS developer using herbicides will be considered a "commercial applicator"¹⁸² making a "commercial application"¹⁸³ of a herbicide under state law. This means that the developer must register with the Pesticides Control Board and pay an annual fee.¹⁸⁴ Each registrant will also be required to demonstrate his competency to use herbicides in accordance with the board's standards, perhaps by examination.¹⁸⁵ He must also demonstrate financial responsibility and maintain records as required by the board.¹⁸⁶ Finally, it is possible that a developer could obtain an exemption from the provisions of the law if he uses herbicides which are not classified restricted and if the board determines the use would constitute no threat to public health.¹⁸⁷

Developers can escape the provisions of the control laws by contracting with an outside firm to apply the herbicides. Persons or companies providing this service are classified "commercial applicators for hire" by the New Hampshire law¹⁸⁸ and are responsible for meeting the obligations imposed by that law.

2. Noise Control

The Noise Control Act of 1972 is Congress's attempt at noise control.¹⁸⁹ It grants the EPA the authority to identify major sources of noise pollution¹⁹⁰ and to promulgate noise emission standards for products in commerce.¹⁹¹ One

category that standards may be written for is "electrical or electronic equipment."¹⁹² The noise emission standards adopted must be feasible and required to protect the public health.¹⁹³

It is unlikely that these requirements will have any effect on WECS. Firstly, wind machines are not expected to produce significant amounts of noise and EPA does not currently consider them major noise sources.¹⁹⁴ Secondly, noise standards, if and when adopted, will be prospective. They will regulate systems to be manufactured. The Noise Control Act does not regulate the operation of existing machinery. Even if noise is generated during construction of a WECS, the Noise Control Act should not be of great concern to the developer. EPA has promulgated emission standards for some construction equipment, but as is the case with other noise emission standards these regulations pertain to the manufacturer of the equipment.¹⁹⁵

New Hampshire city councils have the power to abate nuisances within their jurisdiction.¹⁹⁶ If a WECS made a large amount of annoying noise, the town would have the power to control it. This seems unlikely not only because WECS are relatively quiet, but also because likely WECS sites are some distance from population centers.

3. Soil Conservation

There is much legislation concerning soil conservation, the establishment of the Soil Conservation Service and soil conservation districts, but there is no authority in these laws to regulate private actions disrupting the soil.¹⁹⁷ Soil conservation districts established under the State Conservation Committee may have useful information on construction techniques which WECS developers can use to minimize soil erosion.¹⁹⁸

The state may show more interest in activities which take place on state-owned lands. The conservation districts and district supervisors have the power "to carry out preventative and control measures and works of improvement for the conservation. . . of the soil . . . on lands owned or controlled by the state"¹⁹⁹ The WECS developer building on state lands would be wise to consult the local conservation district to see if it intends to regulate construction in any way.

4. Air and Water Pollution

An extensive system of water and air pollution regulation has been enacted at the federal level with complementary legislation at the state level. It is expected that none of these laws will affect the development of WECS. Wind machines are not expected to be a source of air pollution under the Clean Air Act of 1977.²⁰⁰ The act does establish emission standards for some construction equipment²⁰¹ but, like noise control, only the manufacturer, not the user, is regulated.

The federal Clean Water Act of 1977²⁰² and the state water pollution law²⁰³ regulate discharges or disposal into surface waters. The operation of a WECS will not involve any such discharges. The possible run-off from a construction site is also free from regulation under the water acts because the main focus of water pollution control law is the regulation of "point sources". The definition of "point sources" excludes possible pollution from construction site run-off.²⁰⁴

D. Environmental Preservation

1. Fauna and Flora

a. Migratory Birds

The Migratory Bird Treaty Act²⁰⁵ and the state statute protecting migratory birds²⁰⁶ may pose some problems for WECS operators. The uncertainty of bird kills was discussed previously in section 5e.

Both acts penalize any person or corporation which takes or kills any migratory bird by any method or at any time.²⁰⁷ The federal act imposes a fine of up to five hundred dollars and a sentence of up to six months imprisonment per violation.²⁰⁸ The motive of the violator is irrelevant as the statute does not require a knowing violation.²⁰⁹ If a migratory bird is killed, the statute has been violated and some form of penalty may be imposed. The Fish and Wildlife Service is responsible for determining which species are protected under the act²¹⁰ and, along with the Justice Department, is responsible for enforcing the law with respect to these species.

There are, of course, exemptions from the penalties imposed by the act²¹¹ and permits are available from the U.S. Fish and Wildlife Service.²¹²

But the permits are for hunting migratory birds and scientific purposes. It is doubtful that any WECS operator would be able to obtain a permit to kill migratory birds.

It remains to be seen whether or not the Fish and Wildlife Service or the Justice Department will enforce these provisions against WECS operators. The probability is that isolated kills will not provoke enforcement.

b. Endangered Species

The Endangered Species Act of 1973²¹³ prohibits the taking, harassing or harming of any endangered species of plant or animal.²¹⁴ An endangered species is one "which is in danger of extinction throughout all or a significant portion of its range. . . ."²¹⁵ The Secretary of Interior is required to use administrative rulemaking procedures to determine which species are endangered or are threatened with becoming endangered.²¹⁶ List of these species are published in the Code of Federal Regulations.²¹⁷ Some migratory birds are included on the endangered species list, but these prohibitions should be of little concern to the WECS developer because, in this case, penalties can only be imposed on those who knowingly violate the act.²¹⁸ The requirement of some intent to violate the law will probably free any developer from liability. The Secretary is also empowered to define as critical habitats those areas occupied by endangered or threatened species.²¹⁹ These areas are also defined by rulemaking processes and published in the Code of Federal Regulations.²²⁰ There are currently no critical habitats in New Hampshire.

Developers should be concerned, however, with the requirements imposed on federal agencies under the act. Firstly, before a federal agency can undertake an action it is required to consult with the Secretary of the Interior to determine whether any endangered or threatened species may be in the area of the proposed action.²²¹ If an endangered or threatened species may be present, the federal agency must conduct a biological assessment to determine the effect its action would have on the species. This may be part of an environmental assessment or EIS prepared to satisfy NEPA.²²²

Secondly, an agency can participate in a federal action either directly or indirectly through funding or permitting a project. But in either case the act requires that each agency ensure that it ". . . does not jeopardize the continued existence of any endangered or threatened species

or result in the destruction or adverse modification of habitat of such species. . . ."223 Exemptions from this requirement are available but they are limited to specific cases of significant import. An example would be cases of "no reasonable and prudent alternative to the agency action."²²⁴ It is unlikely that a WECS developer would be able to obtain an exemption.

New Hampshire has a new endangered species act which applies only to wildlife. However, it does not create additional requirements above those outlined in the federal acts.²²⁵

Still, the easiest way to avoid the requirements of the endangered species laws is to carefully choose a development site which will not affect these species.

c. Eagles

Eagles are protected by both the Migratory Bird Treaty Act, the Endangered Species Act and the complementary state laws; however, there is additional protection for eagles.²²⁶ Criminal penalties may be imposed if one intends to violate this law, but if no intent exists one still may be subject to stiff monetary penalties of up to \$5,000. The Secretary of Interior is free to vary the assessment of this penalty for good cause shown.²²⁷ As in the case of other migratory birds, permits are available which exempt persons from the operation of the act,²²⁸ but these permits will not be available to WECS operators as they are granted for scientific purposes only. It is doubtful that the Fish and Wildlife Service would invoke this law in the unlikely event that an eagle will be killed by a wind machine. Still, developers should be aware of all possibilities.

d. Fish and Wildlife

Other laws pertaining to fish and game should not concern the WECS developer. The most prominent federal law, the Fish and Wildlife Coordination Act,²²⁹ applies to federal projects which divert or modify streams, lakes or ponds. This kind of construction activity is unnecessary for WECS. The New Hampshire Fish and Game laws²³⁰ relate mainly to hunting and fishing as sports.

2. Land

a. Wilderness

The preservation of pristine areas is envisioned by the Wilderness Act.²³¹ Through it, Congress has established a mechanism for the designation,

preservation and use of the few areas generally untouched by man in the United States.

Congress may designate certain federal lands as wilderness areas following a recommendation by the President.²³² To date only one such area exists in New Hampshire: the Presidential Range-Dry River Wilderness in the White Mountains National Forest.²³³

The use of wilderness areas is strictly regulated. Congress stated:

. . .there shall be no commercial enterprise and no permanent road within any wilderness area . . . there shall be no temporary road, no use of motorized vehicles . . . no other forms of mechanical transport, and no structure or installation within any such area.²³⁴

Furthermore, Forest Service regulations state that ". . . electronic installations and similar structures and use are prohibited in National Forest Wilderness."²³⁵

But, as in most cases, exceptions are provided and one exception is of particular importance to WECS developers:

Within the wilderness areas in the National Forest designated by this chapter, (1) the President may, within a specific area and in accordance with such regulations as he may deem desirable, authorize . . . the establishment and maintenance of . . . power projects, transmission lines, and other facilities in the public interest, including the road construction and maintenance essential to development . . . upon his determination that such use . . . will better serve the interests of the United States and the people thereof than will its denial . . .²³⁶

It may be difficult to convince the President that WECS construction should be authorized under this exception. Certainly if the wind regime in the wilderness has particularly favorable characteristics not found elsewhere, and if the quest for energy becomes very intense, this use of a wilderness may be available. Alternatively, this set of laws and regulations can be avoided altogether by utilizing WECS sites outside of wilderness areas.

b. Wild and Scenic Rivers

Congress established the National Wild and Scenic Rivers System to preserve unusually scenic and primitive areas which have special value for wildlife or recreational purposes.²³⁷ The act directs Congress to classify rivers as wild, scenic, or recreational²³⁸ and appropriate funds

for the purchase of property contiguous to those rivers.²³⁹ The Secretary of the Interior and the Secretary of Agriculture are empowered to make these purchases.²⁴⁰

The effect of this act on WECS in New Hampshire is likely to be minimal. Firstly, river valleys are not optimal WECS sites. Secondly, Congress has not yet classified any New Hampshire rivers under the act,²⁴¹ but if and when lands are purchased for wild and scenic rivers, use restrictions will be imposed. The agency which purchases the property must manage it with the goal of protecting and enhancing its aesthetic, scenic, cultural and scientific values.²⁴² This does not rule out WECS, but does make their development in areas managed under this act unlikely.

c. Wetlands Protection

The federal government does not control the actions private individuals take with respect to inland wetlands,²⁴³ but it does control the actions its agencies take which affect wetlands. This has been done via two Executive Orders, one concerning flood plain management²⁴⁴ and the other wetlands protection.²⁴⁵

The flood plain order states that each agency shall determine whether a proposed action, including licensing and funding actions, will occur in a flood plain.²⁴⁶ It is then required to consider alternatives which would minimize the adverse effects of construction in a flood plain and justify its decision on these alternatives.²⁴⁷

The wetlands protection order only applies to those federal actions which may affect a federally owned wetland.²⁴⁸ Federal agencies shall not undertake or assist in any construction in wetlands unless there is no practicable alternative and all efforts to minimize the adverse affects on the wetland have been taken.²⁴⁹

In most cases, these orders will have no effect on WECS development because flood plains and wetlands will not usually be favorable sites. If a desirable site is located in a flood plain and if there is some federal action involved, the floodplain order will apply. If a favorable site is located in a federally owned wetland, some federal action must be involved and the wetlands protection order will probably prohibit development. If the wetland is not federally owned, state law will apply.

New Hampshire has also adopted a wetlands protection act.²⁵⁰ It provides supervision of any dredging or filling of a wetland in or adjacent

to the surface waters of the state. The developer must notify the Water Resources Board of actions he proposes to take in wetlands.²⁵¹ The Board shall hold a hearing and is then empowered to grant a permit or conditional permit for the action.²⁵² Developers who fail to get a permit or disobey a permit are liable for civil penalties.²⁵³ Town selectmen also have the authority to allow, and presumably disallow, the draining and refilling of wetlands.²⁵⁴ The commission may then regulate the uses of its land for conservation purposes.²⁵⁶

d. Refuges

The National Wildlife Refuge Administration Act of 1966²⁵⁷ designated certain kinds of land and interests in land held by the Fish and Wildlife Service as the National Wildlife Refuge System.²⁵⁸ The Secretary of Interior is authorized to permit uses of this land which are compatible with the purposes for which the land is owned.²⁵⁹ It is not likely that WECS would be permitted as many refuges are specifically for the propagation of birds. However, these lands may be used for power lines with permission from the Secretary.

Land may also be acquired by New Hampshire for the propagation of game.²⁶⁰ The Director of the Fish and Game Department may regulate the use of these lands and may be willing to permit a WECS.²⁶¹

The construction of WECS in game refuges only depends on the acquisition of the necessary permit. The granting of such a permit will be based on the use of the land by the government and the effect a WECS would have on that use. Development in these areas will be at the discretion of the relevant agency.

e. Trails

The construction of a WECS near a protected trail will also require the acquisition of a permit. The National Trails System Act grants the Secretary of Interior the power to acquire land and rights-of-way for the protection of certain trails as designated by Congress.²⁶² The Secretary may designate connecting side trails as trails also under the protection of this act.²⁶³ In addition, the Secretary is authorized to regulate uses along trail rights-of-way as long as such uses do not interfere with the nature and purpose of the trail.²⁶⁴ Of all the national recreational trails, national historic trails, and national scenic trails designated, only one,

the Appalachian Trail, traverses New Hampshire. Developers must be aware of the need for a permit before constructing a WECS close to the trail.

The responsibility for state trail protection has been placed on the Commissioner of the Department of Resources and Economic Development.²⁶⁵ He has the authority to develop and acquire land and easements for a statewide system of trails.²⁶⁶ Users of state lands held for trails or private lands abutting trails must receive a permit from the Commissioner.²⁶⁷ No use will be authorized if it substantially conflicts with the primary purpose of the trail, which is the preservation of scenic beauty.²⁶⁸

In both situations, at the federal level and the state level, permits will be needed for construction near trails. In both situations the permitting authority exercises discretion over the issuance of permits. This could pose a significant barrier to WECS development in the vicinity of trails.

3. Preservation of Historic Structures and Districts

The National Historic Sites Act²⁶⁹ regulates federal agencies, not developers; however, this act could cause construction delays and developers should be aware of it. Basically the act, as it relates to WECS, states that when an agency becomes aware that its action (construction or licensing) may cause the loss of significant scientific, historic, or archaeological data, it must inform the Secretary of Interior.²⁷⁰ The Secretary is then required to investigate and take the necessary steps to save the appropriate data.²⁷¹ If the operation of the Act causes construction delays and increased costs, compensation may be provided.²⁷²

The National Historic Preservation Act²⁷³ established a procedure, not unlike NEPA procedures, which agencies shall use in decision making to ensure that the effects of their actions on historic buildings and sites are fully considered. Structures and places of particular historic and architectural significance can be nominated to the National Register of Historic Places by states and federal agencies. The Secretary of Interior, through the Advisory Council on Historic Preservation, will then decide on eligibility for inclusion in the Register.²⁷⁴ Federal agencies must consider the possible effect of their actions upon any site or district eligible for or included in the National Register.²⁷⁵

The State Historic Preservation Office was established to work in conjunction with the Department of Interior.²⁷⁶ Its main duties involve the preparation of a state plan for historic preservation and a survey of the state for historic sites.²⁷⁷ The State Historic Preservation Review Board²⁷⁸ will then approve nominations for the National Register.²⁷⁹

The National Register is published and amendments appear in the Federal Register.²⁸⁰ Many buildings and areas in New Hampshire appear in the Register²⁸¹ but the Historic Preservation Act should have little impact on WECS development in spite of the number of New Hampshire historic sites. It is anticipated that the most favorable WECS sites will not be in population centers where most of the historic structures and districts are located.

E. Conclusion

The environmental laws should be of great concern, but they should not be a great burden to the WECS developer in New Hampshire.

Firstly, if the project has some federal connection it is likely that an Environmental Impact Statement will be required prior to federal approval, at least until there is general familiarity with WECS impacts. The impacts of WECS on migratory birds, aesthetics, and airwave transmissions could be significant, but the burden of preparing the study lies with the federal agencies. This burden should be greatly reduced by the new CEQ regulations. Furthermore, NEPA, by itself, will not dictate an agency's decision; it will dictate only the process by which the decision is made.

Secondly, by careful site selection a developer can avoid many of the requirements imposed by environmental laws. The laws protecting endangered species, wilderness areas, wild and scenic rivers, wildlife refuges, wetlands, selected trails, and historic places need not apply to wind development at all.

Lastly, the developer may not be able to avoid conflict with the laws protecting migratory birds, but enforcement of those laws against a WECS developer is unlikely. The effects of WECS operation on airwave transmissions are more definite. In this case, however, all but the effects on television transmissions can be avoided by prudent site selection. Cable television can be used to eliminate the remaining impacts.

The barriers imposed on WECS development by these environmental laws are, therefore, relatively easy to overcome.

6.5 REGULATORY ISSUE RAISED BY WECS INTERFERENCE WITH BROADCAST SIGNALS

In 1934, the U.S. Congress enacted the Communications Act of 1934.²⁸² The purpose of the act was to regulate interstate and foreign commerce in communication by wire and radio in order to assure ". . . a rapid, efficient, nationwide, and world-wide wire and radio communication service. . . ." ²⁸³ In pursuit of this goal, the act created the Federal Communications Commission (FCC).²⁸⁴ The regulatory provisions of the act apply: ". . . to all interstate and foreign communications by wire or radio and all interstate and foreign transmission of energy by radio. . . ." ²⁸⁵

The relevant definition from the act is that of "radio communication" or "communication by radio."²⁸⁶ These phrases refer to ". . . the transmission by radio of writing, signs, signals, pictures, and sounds of all kinds. . . ." ²⁸⁷ This definition has been held to apply to television signals as well.²⁸⁸

In 1968, a new section relating to "Devices which interfere with radio reception; regulations; restrictions; exceptions"²⁸⁹ was added to the 1934 Act. The purpose of the 1968 amendment to the Communications Act of 1934 ". . . is to give the Federal Communications Commission (FCC) adequate authority to deal with increasingly acute interference problems arising from the expanding usage of electrical and electronic devices which cause, or are capable of causing, harmful interference to radio reception."²⁹⁰ The more specific purpose of the legislation was to provide statutory authority for the FCC to prohibit the manufacture, sale, and use of devices which are capable of emitting radio frequency energy of sufficient magnitude to produce harmful interference to radio communications. It appears that this section is applicable only to radio frequency emitters. The legislative history notes such items as high-powered electronic heaters, diathermy machines, and weldors. . . [and] low-power devices such as electronic garage door openers. . . ." ²⁹¹ as examples. There is no apparent FCC authority to regulate disruption caused by devices other than such frequency emitters.

The question of FCC jurisdiction depends upon whether the interference caused by a WECS fits within the definition of a radio frequency emitter. Radio frequency

energy is defined by the FCC as electromagnetic energy between 10 KHZ and 3,000,000 MHA.²⁹² The disruption caused by WECS apparently is caused by scattering of the signal, and not by any frequency emission. "In the vicinity of an appropriately oriented windmill, a TV receiver will receive the windmill scattered signals in addition to the direct signals."²⁹³ Consequently, it seems there is no directly applicable provision of the Communications Act to govern WECS produced interference.

Since explicit regulatory authority does not exist, the issue is whether the FCC has the inherent authority to regulate devices which cause harmful interference by scattering existing signals rather than emitting radio frequencies. In view of the fact that Congress believed it necessary to explicitly provide for FCC jurisdiction over radio frequency emitters via the 1968 legislation, it can be concluded that no specific authority would exist in the absence of such legislation. The same reasoning may be applied to the question of jurisdiction over devices which scatter signals. Accordingly, WECS interference with broadcast signals would not be subject to regulation by the FCC,²⁹⁴ although such effects would certainly be a factor in an environmental evaluation.

6.6 MARKETING WIND ENERGY CONVERSION SYSTEM POWER

A. Introduction

The purpose of this section is to discuss the issues arising from the need to market the power generated by a large-scale WECS. Analysis of these issues will involve examination of the relationship between a WECS owner and an electric utility in addition to the regulation of WECS producers by the Federal Energy Regulatory Commission (FERC) and the New Hampshire Public Utilities Commission (PUC).

Two statutes are especially relevant. Title II of the Public Utility Regulatory Policies Act of 1978 (PURPA)²⁹⁵ and the New Hampshire Limited Electrical Energy Producers Act²⁹⁶ are both designed to encourage the use of renewable energy sources for electricity, and virtually assure that small independent producers can be connected to a power grid if the small producer can meet certain conditions.

This part will elucidate the limiting conditions, and thereby indicate the parameters of these new laws. Since both of these statutes are relatively new (1978), their limits are as yet untested and it is not clear how certain required considerations such as "reliability" will be interpreted by those who implement the acts, even though the general language regarding legislative intent is clear. The discussion below should be read with this general uncertainty in mind.

Section IV, B 1 will give a general overview of the two laws, discuss the apparent intent of their provisions and indicate uncertainties of implementation. Section IV B 2 will discuss the possibility of federal pre-emption and raise issues relevant to the question of federal and/or state jurisdiction over rate regulation (both technically and practically). Clarification of the areas of regulatory jurisdiction and the probable operational interpretation of the two acts will give a potential small electrical producer a better idea of the probability of legal success with a particular project.

The probability of economic success based on the legal situation is assessed in Section IV C, and the basic principles which are expected to guide rate regulation are explained.

B. Regulation

1. The Relevant Statutes

a. Public Utility Regulatory Policies Act of 1978

On October 14, 1978, the United States Congress enacted PURPA, and it was signed into law by President Carter on November 9, 1978. Title II of PURPA is entitled "Certain Federal Energy Regulatory Commission and Department of Energy Authorities," and is the portion of the act with which this discussion is concerned.

Title II of PURPA is designed to facilitate the development of renewable source electricity in several ways. It gives the FERC authority, subject to certain conditions, to order interconnection between small electrical producers and electric utilities; it gives the FERC authority to order sales between small producers and utilities; and it clearly contemplates state rate regulation of such sales pursuant to the principles of FERC rules, which are in the process of being promulgated.

The three most relevant sections here are § 202, Interconnection; § 203, Wheeling; and § 204, General Provisions Regarding Certain Inter-

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STUDY OF A WIND ENERGY CONVERSION SYSTEM IN NEW HAMPSHIRE.(U)

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connection and Wheeling Authority. These have been enacted as amendment to Part II of the Federal Power Act (FPA), and are designated as §§ 210,²⁹⁷ 211,²⁹⁸ and 212²⁹⁹ of the FPA respectively. Part II of the FPA is generally concerned with the regulation of electric utility rates by the FERC.³⁰⁰ In addition, § 210 of PURPA,³⁰¹ entitled Cogeneration and Small Power Production (which was not incorporated into the FPA) defines the means by which rates are to be determined. Section 210 may be the key to economic viability. It also provides the opportunity for various regulatory exemptions for small electric producers.

(1) Federal Jurisdiction Prior to PURPA

In order to appreciate the potential importance of Title II of PURPA, it is necessary to understand the regulatory policies which were in existence prior to PURPA, and which PURPA seeks to modify for the benefit of renewable sources of electrical power.

The original Federal Water Power Act³⁰² created the Federal Power Commission (FPC) which was composed of the Secretaries of War, Interior, and Agriculture. Its powers encompassed those necessary for the effective regulation of the nation's water resources and the development of its hydroelectric potential.³⁰³ The original Act of 1920, in essentially its original form, is now Part I of the FPA.³⁰⁴ As described in the U.S. Government Organization Manual:

Part I of the Federal Power Act effectuates the policy of Congress providing for the development and improvement of navigation and the development, transmission, and utilization of power on streams subject to Federal jurisdiction, upon lands of the U.S., and at government dams, by private and public agencies acting under licenses issued by the Commission.³⁰⁵

In 1935, Congress passed the Public Utility Act of 1935.³⁻⁶ Part II of the 1935 Act was entitled "Regulation of Public Utility Companies Engaged in Interstate Commerce"³⁰⁷ and extended the jurisdictional authority of the FPC to nearly all interstate sales of electricity and interstate wholesale sales of electricity for resale. The 1935 Act became Part II of the FPA, and embodies contemporary federal authority for the regulation of utility rates.

In 1977, the authority of the FPC was transferred to the newly-created Department of Energy (DOE), and the principal functions of the FPC were assigned to the new Federal Energy Regulatory Commission (FERC).³⁰⁸ The transfer of power included authority over the regulation of interstate sales of electricity, as well as authority for the licensing of hydroelectric facilities on navigable waterways.

In general, FERC exercises regulatory authority over any sales of electricity at wholesale in interstate commerce and the transmission of electric energy in interstate commerce. The constitutional basis of this federal jurisdiction is regulation of interstate commerce.

The extent of FERC authority to establish rates for interstate sales of electric power was explained by the U.S. Supreme Court in FPC v. Southern California Edison (Colton decision)³⁰⁹ in 1964 and more recently in the 1972 decision of FPC v. Florida Power and Light.³¹⁰ Essentially, these cases specify that federal jurisdiction exists when there is "comingling" of power, and some electricity from one state may cross to another state. Federal jurisdiction is deemed to exist when the interstate grid is utilized to accomplish the sale of electrical energy for resale. The general rules are interpreted to support FERC authority when doubt exists. A wind machine connected to the lines of a regional grid is susceptible to FERC ratemaking authority under the reasoning of these cases.

With respect to interconnection and wheeling, the authority of the FERC was less precisely prescribed. Section 202 of the Federal Power Act³¹¹ is the operable provision for both interconnection and wheeling. The position of the commission has been that, except in emergency situations, the commission could not compel interconnection except under the constraints imposed by Section 202(b). This position has been implicitly accepted by the Supreme Court in Gainesville Utilities Department v. Florida Power Corp.³¹² The conditions for interconnection under Section 202(b) were that the interconnection be in the public interest, place no undue burden on the connecting utility, require no enlargement in generating facilities and that it not impair the ability of the connecting utility to serve its customers. The commission also has the power to apportion the costs of the interconnection. The position of the commission on wheeling up until

enactment of PURPA had been that, except in emergency situations, it could not compel wheeling under any circumstances.³¹³ This position is supported by a majority of the Supreme Court in various dicta and Justice Stewart Potter's dissent in Otter Trail Power Co. v. United States.³¹⁴ An exception to this rule is occasioned when the transmission line over which the power is being wheeled is licensed by the FERC (e.g., transmission lines of licensed hydroelectric projects),³¹⁵ or when the transmission line in question crosses federal lands.³¹⁶

The restrictions against wheeling and interconnection in the Federal Power Act effectively barred access by small, non-integrated systems to the large integrated systems dominated by privately owned utilities. In terms of marketability of power, the barriers to entry created by private ownership of integrated systems by monopoly entities and the perceived lack of jurisdiction of the FERC/EPC discouraged small independent producers.

(2) State Jurisdiction Prior to PURPA

The state regulatory bodies have exercised authority over those relationships for which federal jurisdiction is not appropriate and which are not covered by the FPA. However, in fact, there is overlap in other jurisdictions of the state and federal governments. The FPA provides that federal authority is ". . . to extend only to those matters which are not subject to regulation by the states."³¹⁷ When the Ninth Circuit Court of Appeals³¹⁸ invalidated an FPC order on the rationale that the above limiting language confined the FPC's authority to those relationships constitutionally beyond the range of a state's authority by virtue of the Commerce Clause,³¹⁹ the U.S. Supreme Court reversed, ruling that federal authority was pervasive in the areas described, and was not limited by potential state authority.³²⁰

Generally, state authority is exercised over rates charged to ultimate consumers, i.e., retail rates. These are considered strictly intrastate sales. A state may also regulate relationships where, even though federal authority has been created by the Congress, the FERC has not chosen to assert its full powers. (See discussion of pre-emption later in this section.) This suggests that the sale of power from a utility to a small producer (as back-up perhaps) may be subject only to state authority. This

may become an important factor when a utility seeks to charge a small producer a premium in compensation for unpredictable demand.

(3) The Contemplated Effect of PURPA on the FERC's Jurisdictional Powers

The above discussion indicates several reasons that small power producers have not been able to operate in the past. The function of Title II of PURPA is to overcome some of these institutional (that is, non-economic) prohibitions. This section will discuss the four principal tenets of the act which are expected to improve the feasibility of power production from relatively small producers. In short, an electric utility may be ordered to "interconnect" with a small producer (subject to conditions), to purchase the producer's output and supply its owner with back-up power, to "wheel" power over its lines for a small power producer (subject to rather strenuous conditions) and, finally, the small producer may be exempted from certain FERC and state regulatory requirements.

(a) Definitions and Concepts of PURPA

Title II of PURPA adds several new definitions to the FPA. Four are pertinent to this discussion. They are: small power production facility, (SPPF);³²¹ qualifying small power production facility, (QSPPF);³²² qualifying small power producer, (QSPP);³²³ and electric utility.³²⁴

A SPPF is defined as one which "produces electric energy solely by the use, as a primary energy source, of biomass, waste, renewable resources, or any combination thereof",³²⁵ and has a capacity of not more than 80 MW.³²⁶ Wind power is clearly a renewable resource, and excepting the possibility of large wind farms,³²⁷ no machines that exist will produce 80 MW. WECS are clearly within the meaning of the statute.

A QSPPF is a small power facility as described above which meets specified requirements to be interpreted by FERC rulemaking. These additional requirements for qualifying status pertain to fuel use, fuel efficiency, and reliability.³²⁸ These prospective fuel use and fuel efficiency standards are in reference to the use of conventional fuels for start-up or other purposes and, for the most part, are irrelevant to wind machines since WECS obviously use no fuel.

Reliability may be an important limitation on qualification.³²⁹ Also, in order to qualify, a small power facility must be owned by a person³³⁰

not in the electric power business except that which is confined to SPPFs.³³¹ Apparently, this provision was designed to assure that as renewables gained technical and economic feasibility, the utility industry could become more competitive and less dominated by the utilities. This element of the act will serve to stimulate competition in a presently monopolistic market.

A QSPP refers to the owner or operator of a QSPPF.

"Electric utility" means any person or state agency which sells electric energy.³³² This is a comprehensive definition, which includes the small producers as well as the conventional electric utility.

On June 27, 1979, the FERC issued proposed regulations³³³ to define the requirements for qualification of small power production facilities under § 201. The FERC was mindful of the purpose of Title II of PURPA, and especially § 210, as it sought to clarify the definition of § 201. That general purpose is to encourage the development of renewable sources of electricity, without requiring subsidization of small facilities by the utilities ratepayers.

The first requirement is that the applicant qualify for certification as a qualifying facility. The applicant must show that the contemplated energy source is among those described. The applicant must show that discussions have been undertaken with the affected utility and must attach a summary of those discussions with the application. The applicant must also supply technical and financial information. The applicant must notify the utility of its intentions, and any affected party may file a protest. Section 292.205 of the proposed regulations sets forth in greater detail the scope of potentially qualifying facilities. Wind is explicitly included. This section also discusses size limitations. A 2.5 MW WECS is clearly within these limits.³³⁴

(b) Analysis of Wheeling and Interconnection

The new FPA sections 210, 211, and 212 extend the authority of the FERC to order interconnection and wheeling of power beyond the historic limits described above. These sections are the core of Title II, since they provide the thrust of the policy changes and create the potential of success for a small power producer. In addition, § 210 of PURPA outlines the

parameters of the rates at which power will be exchanged between electric utilities and small power producers and mandates implementation of the rate concept by rules.

(i) FPA § 210, Interconnection Authority

The interconnection section provides that the FERC may order the physical connection of any QSPPF to the transmission facilities of any electric utility³³⁵ and may order "such sale or exchange of electric energy . . ." as is necessary to effectuate the above.³³⁶ The commission's decision to issue such an order must be based upon several considerations. The commission must determine that the order is in the public interest.³³⁷ It must also determine that the order would either "encourage overall conservation of energy or capital",³³⁸ "optimize the efficiency of use of facilities and resources",³³⁹ or improve reliability.³⁴⁰ Finally, the commission must determine that any such order meets the requirements of § 212 regarding general provisions applicable to interconnection.³⁴¹

As the above suggests, Title II of PURPA, while its purpose is to encourage small-scale renewable energy development, does not mandate interconnection in all cases. Several subtle determinations must be made. These are primarily concerned with the actual value of the supplemental power from the wind machine to the grid from both a societal and economic point of view. The limitations seek to assure that the "qualifying facility" (QF) does not introduce a diseconomy to the grid, thereby forcing the utility's customers to subsidize the utilization of the small facility.

It appears that WECS will have little difficulty meeting the mandated considerations. Congress has already made the judgment that renewable energy sources are beneficial, and therefore in the public interest, unless a highly mitigating set of circumstances can be shown in a particular case. Since wind machines are clearly within the intent of the statute, it seems most will be found to be in the public interest. Similarly, the act requires that a WECS promote conservation, efficiency, or reliability. Note that the wording clearly suggests satisfaction of any one of these criteria is adequate. Assuming that conservation refers to that of fuel, wind machines are obviously within the spirit of the law. Wind machines

will fare well in the efficiency inquiry, since this again involves fuel use which is not relevant to WECS. It is probable that some WECS will be highly reliable as well.

(ii) FPA § 211, Certain Wheeling Authority

This section gives the FERC authority to order an electric utility to provide power transmission services (wheeling) to interconnected electric utilities, including small power producers, when certain conditions are met. Generally, § 211 (a) provides that any electric utility may apply for an order requiring that transmission services be supplied to it by any other electric utility. The purchaser of the electricity must apply. The requirements noted above in regard to interconnection, i.e., to promote the public interest,³⁴² conserve,³⁴³ promote efficiency,³⁴⁴ increase reliability³⁴⁵ and satisfy § 212,³⁴⁶ are similar when wheeling services are sought. In the case of conservation and efficiency, however, these characteristics must be "significant", implying that a more stringent assessment is to be made of the value of any wheeling order. Section 211 (b) presents a more specific case. Any electric utility which purchases electric energy for resale from any other electric utility may apply for an order requiring the utility selling the power to transmit such power to the purchaser. It is contemplated that this procedure will be used only if the parties to the proposed wheeling arrangement cannot agree on terms. A wheeling order may not be issued under § 211 (a) by the FERC unless the commission determines that such an order would preserve competitive relationships.³⁴⁷ An order may not be issued under § 211(a) or (b) unless it is determined that the electricity provided to the applicant will not replace power currently provided under separate contract or pursuant to existing utility rate schedules,³⁴⁸ and that the transmittal will not be to an ultimate consumer.³⁴⁹ Note the discussion, later in section A.1(b) regarding the New Hampshire wheeling statute which seeks to implement wheeling in conjunction with the Limited Electrical Energy Producers Act.

(iii) FPA § 212, General Provisions Regarding Certain Interconnection and Wheeling Authority

An interconnection or wheeling order may not be issued unless the commission determines that such an order would not unduly burden a utility,³⁵⁰

unreasonably impair the reliability of an electric utility,³⁵¹ impair the utility's ability to provide adequate service³⁵² or result in a "reasonably ascertainable uncompensated economic loss"³⁵³ to the utility. It is obvious again that the FERC interpretation will determine the meaning of these requirements to small power producers. While wheeling holds the potential for making electrical power production more competitive, the large utilities will be very concerned about their control of electrical supply, and may exhibit resistance to the "common carrier" implications of wheeling on the grid.

(c) PURPA, § 210, Cogeneration and Small Power Production

Section 210 of PURPA is not integrated into the FPA. It generally provides that ". . . the Commission shall prescribe . . . such rules as it determines necessary to encourage . . . small power production . . ."³⁵⁴ These rules will require electric utilities to "sell electric energy to qualifying small power production facilities. . ."³⁵⁵ and purchase electric energy from such facilities."³⁵⁶ These rules must include provisions respecting minimum reliability and, in contemplation of wheeling, may not authorize a small power producer to make any sale for purposes other than resale.³⁵⁷ Section 210(b), (c), and (d) set out the limitations on the rates for such sales, as well as the definition of "incremental cost of alternative electric energy."³⁵⁸

Section 210(e) provides that the commission shall prescribe rules under which QFs may be exempted in whole or part from regulation under the FPA, the Public Utility Holding Company Act, and state laws regarding rates, financial or organizational regulation, and other possible impediments to the encouragement of small power production.³⁵⁹

Pursuant to the legislative mandate to establish rules regarding the goals of § 210 of PURPA, the FERC has issued a "Staff Paper Discussing Commission Responsibilities to Establish Rules Regarding Rates and Exemptions for Qualifying Cogeneration and Small Power Production Facilities."³⁶⁰ The Staff Paper sets out the general philosophy and requirements of PURPA and concludes that ". . . there is the potential, if not a requirement for a fundamental re-ordering of the traditional dual [federal/state] regulatory scheme. . ."³⁶¹ Where FERC previously controlled regulation

over interstate sales while states enjoyed authority over retail sales, PURPA contemplates FERC rulemaking jurisdiction over both types of transactions, with respect to small power producers. The Staff Paper notes that the states will probably carry out the day-to-day regulation of interstate sales involving WECS in addition to regulating all retail sales. This state regulation will, however, be conducted in conformity with FERC rules. As summarized by the FERC staff:

In other words, the requirement that the states and non-regulated utilities implement the FERC's rules, together with the FERC's authority to exempt QFs from all of Parts II and III of the FPA and from state law could (and almost certainly will) result in the delegation-by-exemption to the states of both old and new FERC regulatory responsibilities.³⁶²

On October 18, 1979, the FERC promulgated proposed rules³⁶³ by which it seeks to implement § 210 of PURPA regarding both sales between QFs and electric utilities (§ 210(a)) and exemption of QFs from state and federal regulatory laws.

As was suggested in the staff discussion paper, the proposed rules provide that an electric utility must purchase both electric energy and capacity offered by QFs. As noted above, many WECS producers would fall within the definition of Qualifying Small Power Production Facility. As mandated by the legislation, the rules seek to compensate the QF at a rate reflecting the generation or purchased power cost avoided by the electric utility through the purchase of power from the small producer. The rules require that electric utilities supply data on these costs in order to allow potential small producers to estimate the value of their additions.

The rules also exempt small producers from regulation under the Federal Power Act and the Public Utility Holding Company Act, as well as certain state regulatory laws.

The implementation of the rules is left to the state regulatory authorities and non-regulated utilities with the condition that they be implemented within a year.

It cannot be stated with certainty that the regulations which will be adopted as final will be the same as those which were proposed.

b. The Limited Electrical Energy Producers Act

The New Hampshire Limited Electrical Energy Producers Act³⁶⁴ became effective on August 22, 1978. By way of signifying the legislature's intent, it states: "It is found to be in the public interest to provide for small scale and diversified sources of supplemental electric power. . ."³⁶⁵ The act is limited to electrical producers not using nuclear or fossil fuels which have a capacity not greater than 5 MW.³⁶⁶ Unlike PURPA, the act does not exclude municipalities from the benefits of its provisions. Such limited producers ". . . shall not be considered public utilities and shall be exempt from all rules, regulations, and statutes applying to public utilities."³⁶⁷ Since no single WECS has the capability of producing as much as 5 MW, it is clear that a WECS developer would be exempt from regulation in accordance with the provisions of the act. However, the status of a developer who operated a wind farm with a collective capability in excess of 5 MW or of a WECS operated by a public utility is unclear. It is probable that such facilities would not be exempt from regulation. The act also orders that the electric public utility in the franchise area purchase the limited producer's entire output (if offered for sale)³⁶⁸ at a price per KWH to be set by the PUC.³⁶⁹ Any dispute arising under the act may be referred by either party to the PUC for adjudication.³⁷⁰

It appears from the language of the act that the legislature wishes to encourage the use of renewable energy sources without involving state regulatory procedures except to the extent of settling disputes and setting rates. The actual process of incorporating the intent of the legislature may not be so simple, however. Consider, for example, the utilities' reaction to varying degrees of reliability among WECS sources and among similar devices in different environments. The result of these differences is that the value of electric power from small producers will vary. The New Hampshire Act does not address these problems, except to say that the PUC shall set a rate, apparently a single one, applicable to all such sales. Pursuant to the legislative mandate in 1979, the PUC determined two rates.³⁷¹ The lower rate, 4 cents per KWH, was set for small facilities which do not replace capacity because they are relatively unreliable; consequently, the Commission found that such power is only of fuel replacement value. The higher rate, 4.5 cents per KWH, is applicable to sources which, because of

relatively high reliability, do have capacity displacement value. In June 1980, these rates were modified to 7.7 and 8.2 cents per KWH respectively.³⁷² The PUC sought to make some allowance for the basic conceptual difference between highly reliable and less reliable sources. The PUC also recognized that this single distinction may become inadequate as more is learned about the nature of small producers.

The Commission also finds the need to re-examine this issue after the promulgation of PURPA rules by the Federal Energy Regulatory Commission. We also believe that the aforementioned figures should be adjusted annually to reflect new facts and situations. When such re-examination takes place, the Commission will attempt to examine sub-categories based on capacity, energy size, price, existing equipment and financial stability.³⁷²

The 7.7 cents per KWH rate is applicable to WECS and could be considered the relevant rate in assessing the economic feasibility of wind machines. As noted, this is subject to periodic review and is currently under appeal. As required by PURPA, ". . . the primary reference point for determining the price for a sale from a QF to a utility is not the seller's cost, but the buyer's avoided cost."³⁷³

The New Hampshire Legislature also enacted a wheeling provision as an amendment to the Limited Electrical Energy Producers Act.³⁷⁴ It provides that "a limited producer of electrical energy shall have the authority to sell its produced electrical energy to not more than three (3) purchasers other than the franchise electric utility."³⁷⁵ The PUC is not to be involved in setting the terms of such contracts, but may disapprove wheeling contracts if, in its judgment, the contract does not protect the parties against excessive liability or undue risk, entails substantial cost or risk to the electric utility, or is inconsistent with the public good.³⁷⁶

Subsection II of the amendment³⁷⁷ contains the statutory mandate requiring franchised electrical public utilities to transmit power from the producer's facility to the purchaser's facility. It further provides: "the producer shall compensate the transmitter for all costs incurred in wheeling and delivering the current to the purchaser."³⁷⁸ This subsection also gives the PUC authority ". . . to set such terms for a wheeling agreement including price that it deems necessary."³⁷⁹

Subsection III sets out certain findings which must be made by the PUC before ordering an electric utility to wheel electricity. These parallel the limitations on FERC's rulemaking authority as specified in § 210 of PURPA. They are as follows:

. . . the public utilities commission must find that such an order or agreement:

- (a) is not likely to result in a reasonably ascertainable uncompensated loss for any party affected by the wheeling transaction.
- (b) will not place an undue burden on any party affected by the wheeling transaction.
- (c) will not unreasonably impair the reliability of the electric utility wheeling the power.
- (d) will not impair the ability of the franchised electric utility wheeling the power to render adequate service to its customers.³⁸⁰

One of the more significant effects of the wheeling amendment is that it fills a gap left open in PURPA. As previously discussed, PURPA provides that the FERC may not order a utility to wheel power if it is to be sold to the ultimate consumer. The New Hampshire Act specifically allows wheeling of power for retail sale. A small power producer may contract to sell electricity to a buyer other than the franchised utility serving the area, and the PUC is authorized to order that the franchised utility wheel that power through the grid to the purchaser.

2. The Relationship of the State and Federal Statutes: Pre-emption

a. Generally³⁸¹

Pre-emption is the term that describes, in a federalist system, the ability of the law of one sovereign to take precedence over the law of a less sovereign. Specifically, it is the supremacy of the federal law to the state law. The pre-emption doctrine operates, therefore, to nullify state laws.

The United States Constitution establishes the authority of the federal government. It enumerates certain powers which belong to the Congress³⁸² and then declares: "This constitution and the Laws of the United States . . . and all Treaties . . . shall be the supreme Law of the Land; . . . anything in the Constitution or Laws of any State to the Contrary notwithstanding."³⁸³ This, the "Supremacy Clause," means that when the federal

government acts within the scope of its authority, its laws shall pre-empt state laws which infringe upon this authority.³⁸⁴

Thus, before the doctrine of pre-emption can be invoked, the federal measure in question must fall within the authority delegated to the federal government by the Constitution. The states are free to regulate matters outside of the control of the federal government and the federal government cannot pre-empt state laws in these areas.³⁸⁵

Although Congress has pre-emptive authority, it often chooses not to exercise this authority. Instead, it may provide a scheme by which the states and the federal government can jointly regulate an activity. As the power to pre-empt state law rests with the federal lawmakers the intent of the Congress in passing an act will determine the effect that act will have on state law.

The courts will decide when a state law has been pre-empted by a federal law. To do this they must first determine whether the federal law is legitimately within the scope of authority that Congress may exercise. Then courts will decide whether or not Congress intended to pre-empt state law when it passed the particular act.³⁸⁶

The courts will look for congressional intent in the following ways:

- 1) Intent to pre-empt or to allow state regulation may be explicitly stated in the statute. If it is, this statement of intent will be controlling.
- 2) Courts will infer a congressional intent to pre-empt if the Congress has enacted a law which appears to deal with an issue exhaustively, leaving no place for state regulation.³⁸⁷
- 3) If a federal law is based on a need for a uniform system of national regulation, then a congressional intent to pre-empt state law will be found.³⁸⁸
- 4) Courts will also pre-empt state laws when federal and state requirements conflict so that compliance with both laws is impossible.³⁸⁹

When congressional intent is not explicitly stated, only the courts may determine what the intent of Congress was when an act was passed. This means that many pre-emption questions will not be resolved until someone challenges a state law and claims that it is pre-empted by a federal law.

b. Pre-emption and Small Power Production

The following discussion will explain the applicability of the pre-emption doctrine to federal/state jurisdictional questions and the resulting relationship between Title II of PURPA and the New Hampshire Limited Electrical Energy Producers Act. It will also note the new jurisdictional issue posed by the advent of a "new" regulatory object, the small grid-connected electrical producer.

As evidenced by the previous section, the ultimate decision as to whether, and to what extent, authority over subject matter has been pre-empted by the federal government rests in the courts. As no court has ruled on the pre-emption of the New Hampshire Act by Title II of PURPA, this question has yet to be resolved. But by using the analysis that courts use in deciding pre-emption questions, one can determine the likely outcome of a case.

In general it appears that Title II of PURPA does not pre-empt the State Limited Electrical Energy Producers Act. The conflict would obviously arise as a result of the fact that both acts appear to regulate the relationships between a small power producer and an electric utility. However, it is apparent that most of the terms of the two acts are not in conflict. Both seek to encourage the use of renewables by providing for their connection to conventional electric utilities. And, except for one clause, adherence to one act would probably not result in violation of the other.

As previously discussed, the federal government has authority to regulate much of the electricity transmission industry. It is clear that the Congress has authorized the FERC to exercise regulatory authority in any situation involving power supply flows through the interstate power grid. Such interstate flows are deemed to exist where there is a sale for resale with the possibility of commingling of electricity. It is also clear that PURPA gives the FERC rulemaking authority over all phases of the sale of electric power from QFs as well as from the utility to a small producer. The latter would have been considered a retail sale prior to PURPA and hence not subject to federal regulation. The only relationship to which PURPA does not appear to attach FERC rulemaking capability is that which exists between a small producer and one to whom the small producer wishes to wheel electricity

at retail. However, it also appears that, while prescribing rulemaking authority, PURPA does not contemplate the exercise of comprehensive FERC authority over the subject relationships. This, it seems, would be too monumental a task. Rather, PURPA contemplates that the FERC rules provide for state regulation of relationships that have previously been regarded as being subject to federal jurisdiction.³⁹⁰

A court ruling on this pre-emption question would first look for explicit congressional intent in the federal legislation. Congress, in enacting the FPA, evidenced its clear intent not to usurp the traditional regulatory powers of the states.³⁹¹ No language exists in PURPA which would indicate a change in that congressional policy. In addition, a court could not find an implicit congressional intent to pre-empt the state act. It is apparent that: (1) Congress did not intend to set up a comprehensive program effectively exhausting the field; (2) PURPA does not contain the type of regulatory authority requiring national uniformity to be successful; and (3) for the most part the state and federal legislation do not conflict. Thus, it can generally be concluded that the New Hampshire Act has not been pre-empted either by the FPA or PURPA. Since the intent of Congress in enacting PURPA was to encourage the production of electrical energy by small producers, it can be viewed as setting up certain "minimum" standards which the states are free to either adopt or to exceed if done in a manner consistent with the provisions and the policies of the federal legislation.

There is one clause of the New Hampshire Act which appears to be in conflict with PURPA, however. Section three of the New Hampshire Law as amended by the 1979 Session laws states: "No electric public utility shall be required to purchase the entire output of electric energy [of a QF] if the amount of the purchase exceeds 10 percent of the utility's gross sales of electricity."³⁹² Though it is uncertain how this clause will be applied it is apparently in direct conflict with PURPA. Section 210 of the FPA states that the FERC may order the sale or exchange of electricity.³⁹³ This means that a public utility may be required to purchase energy in excess of ten percent of the utility's gross sales. The proposed rules issued by FERC support this analysis. They state that ". . .each electric utility shall purchase . . .any capacity or energy which is made available

. . .by a QF with a few unrelated exceptions.³⁹⁴ The FERC staff paper which accompanies these rules states that "The Commission interprets this provision to impose on electric utilities an obligation to purchase all electric energy and capacity made available from qualifying facilities. . ."³⁹⁵

As noted previously, PURPA seems to establish certain minimum standards which states are free to adopt or exceed. More restrictive standards, however, would not be consistent with the federal legislation. Since the 10 percent clause of the New Hampshire Act is more restrictive than the minimum standards established by PURPA, it would probably be pre-empted by the federal legislation if challenged in court.

Under existing legislation, only a court can determine with finality the effect of the pre-emption doctrine. If a court should determine that the 10 percent clause is pre-empted by PURPA, it must then address the question of what bearing its decision would have on the remainder of the New Hampshire Act. Because the 10 percent clause only appears in an amendment to the New Hampshire Act and is not central to the entire act, a court would probably nullify only the clause and not the entire statute. Hence, the remainder of the New Hampshire Act will probably govern New Hampshire's electric utilities in conjunction with PURPA.

C. Economic Analysis

The purpose of this section is to analyze the general economic implications of Title II of PURPA and the New Hampshire state legislation, with regard to the purchase and sale of electricity between utilities and WECS owners. It will not attempt to determine specific prices at which such power should be exchanged. Rather, it will attempt to ascertain the economic ramifications of the principles envisioned by the Congress and outlined in Title II of PURPA.

In accomplishing this objective, this section will delineate the important variables which are expected to affect the price of electricity subject to exchange under the provisions of PURPA. These variables include the load characteristics of utilities, and reliability of the subject WECS, and the contribution of the wind machine to a utility's capacity.

The most relevant statutory provisions for purposes of this discussion are Section 210(b) and 210(c) of PURPA. Section 210(b) describes the "Rates for

Purchases by Electric Utilities", and specifies that the rates at which such sales are made "shall be just and reasonable to the electric consumers of the electric utility and in the public interest" and shall not discriminate against . . .qualifying small power producers". Regarding "Rates for Sales by Utilities", Section 210(c) also requires that such sales be "just and reasonable and in the public interest", and "shall not discriminate against the . . .qualifying small power producers." These directives are to be implemented by rule promulgated by the FERC, as mandated by Section 210(a). Finally, Section 210(b) reads "No such rule prescribed under subsection (a) shall provide for a rate which exceeds the incremental cost to the electric utility of alternative electric energy."

The key to comprehending the parameters of the rates at which utilities will be required to buy from a WECS is in the definition of "Incremental cost of alternative electric energy", and is embodied in Section 210(d) which reads:

For purposes of this section, the term "incremental cost of alternative electric energy" means, with respect to electric energy purchased from a qualifying small power producer, the cost to the electric utility of the electric energy which, but for the purchase from such small power producer, such utility would generate or purchase from another source.³⁹⁶

This is the definition which, through the FERC rulemaking pursuant to Section 210(a), will dictate the means by which the rate for purchase by the electric utility will be set, if at all, by the state PUC. While the definition appears relatively simple and straightforward, it leaves great uncertainties regarding the value of WECS power to the grid.

The ambiguities of this definition involve primarily three variables which will be discussed here. The first involves the load characteristics of the utility and the time at which the power is available from the WECS. The second variable concerns the reliability of the WECS and the resulting probability that power will be available from the wind machine at any particular time. Finally, a combination of the above two factors leads to a determination of the ultimate contribution of a particular WECS or pool of small producers to the utility's capacity. The conclusion which must be drawn from these variables is the value of power supplied by the WECS which would otherwise have been generated or purchased by the purchasing utility. To illustrate, a WECS which cannot be

relied upon to contribute a peak power displacement may be viewed by the utility as having no capacity displacement value, thereby contributing only the value of unused fuel. Conversely, a WECS with high reliability contributes to the extent of its reliable capacity, the value of otherwise required generation facilities, and thereby offsets the capital costs associated with such facilities. It can be cogently argued that any probability of WECS power can be translated to a degree of reliability, thereby constituting capacity displacement value. This view was adopted by the FERC staff in its paper discussing rules to be promulgated pursuant to § 210 of PURPA:

Our analysis thus leads us to the conclusion that every incidence of a QF's reliability (or unreliability) can be accounted for through prices. . . [w]e would recommend to the Commission that it establish no minimum reliability standard pursuant to Section 210(a), but that it make full provision for the consequences of varying degrees of reliability in the rules on pricing.³⁹⁷

The proposed regulations do not depart from that view. A utility's production capacity can generally be divided into base, intermediate, and peak power categories. Base power is that which is generally least expensive and least susceptible to short-run changes in output. In other words, a base-load plant is designed to run for long periods of time at a relatively constant output. Intermediate loads are those designed to accommodate most of the daily fluctuation in load above base load. At the top end is peak capacity which is usually met by the intermittent and relatively short use of expensive generating equipment utilizing diesel or gas generators, or peaking hydro capacity. This power is the most expensive to the utility because it generally uses high-cost fuels and requires the maintenance of relatively large capital equipment utilized only on an occasional basis for peak requirements. Supplementary WECS power will not contribute a capacity displacement function unless it can be relied upon at times of peak generation. If it cannot, the utility will be forced to maintain its total paid capacity regardless of the WECS.

Reliability refers generally to the probability that a WECS will supply power to the electric grid at any given time. The intermittency of wind detracts from its reliability to the grid, thereby decreasing its value. The unpredictability of this intermittency, of course, exacerbates the problem.

It has been argued that a single WECS will improve reliability (or increase capacity) by exactly zero since no reliable prediction can be made as to whether power will be available from a WECS at any given time. A particularly temperamental site may actually be "more trouble than it's worth" to a utility whereas a very consistent WECS would have valuable capital displacement potential. It seems likely that an electric utility will assert that in any instance when a wind machine attains an overall reliability lower than the utility's least reliable power plant, the WECS power is worth less than the fuel costs plus capital costs of that plant. Reliability is therefore distinctly related to the value of a WECS to a power grid.

The definition of incremental cost referred to above essentially suggests that an electric utility should be required to purchase power from a WECS at its marginal cost. Marginal cost refers to the cost associated with an additional unit of output. In the case of an electric utility, the marginal cost offset by a WECS on the grid would be that power which would have been generated or purchased but for the contribution of the wind machine.

This value can be determined rather easily at any given time when the value of capital displacement is ignored. In other words, generation from a WECS at a particular moment can simply be viewed as displacing X number of units of the utility's required output, whether it be during a period of low demand or a period of peak demand. Obviously, the value of power at times of peak demand is greater to the utility than it would be during periods when only base load generating facilities are in operation. This occurs because the cost of producing the next "marginal" unit with peaking capacity is greater than producing it from a baseload plant. However, the above considerations take into account only the cost of fuel and ignore the possibility that small power producers may, either individually or as a pooled group, add significantly to the quantity of reliable power available to the utility at any given time, thereby eliminating the need for the utility to purchase or construct additional capacity and lending much greater value to the utility than just the short-run fuel replacement costs.

This more difficult problem requires a determination of the reliability of a particular wind machine and the consequent contribution to the electric utility's capacity. A 2.5 MW wind machine which can be counted upon to run all of the time would eliminate the necessity for the utility to construct and

and operate 2.5 MWs of capacity. On the other hand, a similar machine which contributed only sporadically, would not allow the electric utility to avoid the 2.5 MW investment, but only some smaller amount consistent with its reliability factor. Therefore, such a WECS contributes only the value of the fuel displaced by it and perhaps a smaller amount in the form of capital value.

The essential point is that reliability has a value distinct from and in addition to the value of generated electricity. This additional value increases as a function of the reliability of the WECS in question. Reliability has a capital displacement value which must be ascertained and credited in order to assure that a WECS owner is properly compensated for the value of its power to the grid.

Prior to the passage of PURPA, the New Hampshire PUC held hearings regarding rates at which electric utilities would be required to purchase power from small power producers pursuant to the NH Limited Electric Producers Act. As might be expected, the meaning of the definition of incremental cost was a source of controversy. The PUC attempted to resolve partially the reliability problem posed above. The principle issue confronting the PUC regarded the question of whether incremental cost involved only the defrayed cost of immediately available power (a short-run perspective) or whether the level of reliability should be considered in the determination of a price, inasmuch as that reliability obviously affected capacity. The Commission noted a passage from the Committee Conference Report of the U.S. Congress on PURPA, which states:

In interpreting the term "incremental cost of alternative energy", the conferees expect that the Commission and the States may look beyond the cost of alternative sources which are instantaneously available to the utility. Rather, the Commission and States should look to the reliability of that power to the utility and the cost savings to the utility which may result at some later date by reason of supply to the utility at that time, of power from the . . . small power producer. . . 398

With regard to the above, in 1979 the New Hampshire Commission made the following findings:

As a consequence, the Commission finds that 4.5 cents per KWH is a reasonable price for producers of electric energy, not involving the use of nuclear or fossil fuel, where the plants will provide both capacity and energy. This finding is based on (1) the legislative intent of both RSA 362-A and PURPA, (2)

the projected cost of the next major generating station - Seabrook, (3) the present cost of existing capacity to Public Service Company, (4) the testimony and evidence in this proceeding, (5) the absence of specific rules and rulemaking procedures related to PURPA.

For plants that provide only energy, e.g. run-of-the-river hydro facilities, the Commission finds that 4 cents per KWH is a reasonable price for producers of electric energy not involving the use of nuclear or fossil fuels. This finding is based on (1) the legislative intent of both RSA 362-A and PURPA (2) the cost determined to be reasonable for plants which provide both capacity and energy (3) the testimony and evidence in this proceeding with special emphasis on the ability to substitute hydro for barrels of oil (4) the absence of specific rules and rulemaking procedures related to PURPA. (Emphasis in original)³⁹⁹

Obviously, this solution does not take account of full range of various levels of reliability which might be encountered by different WECS, but it does constitute an initial recognition that such facilities may provide the benefit of long-range capacity to the utility. The degree of reliability to which a WECS can commit itself can and should be reflected in remuneration for the service, and the initial attempt by the PUC to recognize this will encourage the development of WECS. The exact degree to which the rate paid by a purchasing utility to a QF will include a capacity component must vary with the degree to which the QFs power enables the utility to avoid alternative capacity costs. This is necessary due to the act's requirement that QFs not be subsidized by ratepayers. However, the additional requirement that rates be non-discriminatory, combined with the fact that Congress is actively seeking to further the development of small power producers, mandates that if service has capacity value to a purchasing utility, the utility must pay the value as long as it does not exceed the utility's long-run incremental costs.

6.7 SITE SPECIFIC ISSUES - EXECUTIVE SUMMARY

A. INTRODUCTION

This section analyzes the legal and institutional barrier to the construction and operation of a large-scale wind energy conversion system (WECS) at eight specific sites selected by the Mount Washington Observatory and the University of New Hampshire. It represents the second half of the work performed for the Department of the Navy under a subcontract from the University of New Hampshire.

After a description of the site, the land use factors, including the owner's concerns, and the likely environmental impacts are discussed. The studies then identify the potential developers for a particular site and discusses problems associated with the use or marketing of wind generated power at the site.

The discussion of land use factors and environmental impacts includes an analysis of the physical characteristics requisite for an acceptable WECS site. These include space, access for machinery and equipment, and proximity to electrical transmission facilities. To establish a frame of reference, the case studies were based on the assumption that a WECS of the size of a Boeing Mod-2 would be constructed on each site. A machine this size, with a hub height of 200 feet and a rotor diameter of 300 feet, would require approximately two acres of land. Some method of access must be devised to transport the pieces of machinery and equipment at most of the sites studied. This could be a distinct problem because the longest of the Mod-2 pieces is a 75-foot rotor section. The 41-foot nacelle is the heaviest piece at 75 tons. Helicopter transport and assembly are not feasible. Smaller wind turbines which do not require as much space and are easier to transport and assemble may therefore be appropriate at some sites where a larger Mod-2 type of machine is not feasible.

The Mount Washington Observatory selected the sites for the primary purpose of gathering wind data. The sites are scattered throughout the state at various elevations and are owned by a variety of individuals and institutions.

Little Attitash Mountain (2518') is in the White Mountain National Forest (WMNF). Though it is owned by the federal government, a portion of the mountain is used as a ski resort. Cannon Mountain (4060') is in the WMNF region and is host to a ski resort, but it is largely owned by the state. Cardigan Mountain (3121') which is also state owned, is in central New Hampshire. Crotched Mountain (2055'), in southcentral New Hampshire, Dalton Ridge (2142'), a part of the upper Connecticut River Valley, Dixville Peak (3482') in the northern third of the state and Moose Mountain (2300'), outside of Hanover, are all privately owned peaks. Finally, Wildcat Mountain (4415'), like Little Attitash, is located in the WMNF and is the site of a ski resort.

B. ANALYSIS

Of the eight sites considered in these studies none of them were without obstacles. These obstacles could be generally described as being either geographical, environmental, economic or arising from governmental restrictions. In some cases the obstacles could be easily overcome. The necessity of building a one mile road is obviously more of an obstacle than the necessity of a half-mile road, but it may not weigh heavily in a developer's mind when other factors are compared. Conversely, a conflict with the Appalachian Trail (AT) would entirely preclude development, unless the conflict itself could be avoided by compromising on siting. Economic obstacles are primarily important in determining when development is feasible, rather than if development is feasible.

Any general comparison of the sites requires judgments to be made as to the weight of each obstacle and doing so involves an element of subjectivity. The reader should also be aware that many of the conditions described in these studies are subject to change.

Both Dalton Ridge and Dixville Peak had features which made them appear to be favorable sites for development. Attitash and Crotched Mountain were less favorable. The obstacles at Wildcat Mountain, Cardigan Mountain, Moose Mountain, and Cannon Mountain were significant enough to make development appear to be not feasible.

Dalton Ridge is an attractive site in large part because it lacks the problems associated with other sites. Because the land is privately owned, an abundance of governmental restrictions are avoided, yet private ownership of the land creates an unpredictable situation. The owners of this land seem interested in WECS development. Adequate space for siting does not pose a problem; however, it is likely that negotiations will have to be conducted with more than one owner because the property line follows the ridge. Notable economic considerations include the fact that the area is entirely wooded, roughly one half mile of jeep trail would have to be upgraded to provide access for construction and maintenance and the cost of interconnection with the electrical grid in the area could vary from \$71,500 to \$90,000. A less expensive alternative may be available if an existing transmission line running within one quarter mile of the site could be utilized.

Dixville Peak is similarly attractive. It is also privately owned land. Unlike Dalton, the owners do not seem amenable to development unless it appears to be a cost effective alternative of providing electric service for on-site usage at a hotel, factory and ski area. Economics, thus, could postpone indefinitely the development of the site. The cost of developing this site will depend on how much it costs to build approximately one mile of access road and the final cost of interconnection which is expected to be around \$90,000.

Little Attitash Mountain is publicly owned land, managed by the United States Forest Service (USFS). Thus, development depends on a developer's ability to get a special use permit. WECS development in this area does not appear to conflict with Forest Service management policies. However, any permit will be contingent on an acceptable Environmental Assessment (EA) or an Environmental Impact Statement (EIS). In performing an EIS, the significant visual impact of a large scale WECS on this mountain must be addressed. In addition, the developer will have to avoid conflicts with the ski area. Otherwise, the site appears favorable. Attitash Lift Corporation is presently installing a WECS for its own use. In conjunction

with this development, electrical transmission lines are being installed which would be sufficient for a large-scale machine. Parts for construction of the WECS of the size planned by the ski area can be transferred by helicopter. Parts for a Mod-2 are too heavy for helicopter transfer. Thus, a Mod-2 developer would have to construct his own access road at an undetermined cost.

The Crotched Mountain site chosen by the Mount Washington Observatory similarly will require construction of an access road approximately .4 miles in length, rising 700 feet from the base of the ski area to the summit. The summit is sharply peaked so there is the issue of whether sufficient level space exists for siting a large-scale machine. The Franconia zoning ordinance, applicable to the area, is somewhat ambiguous. It does not, however, seem to prohibit WECS development on its face. The area within 2.5 to 3 miles of Crotched Mountain is much more populated than areas surrounding other sites. For this reason, the aesthetic impact may become a hotly debated issue. Potential television interference will be a less important issue because few residences will be affected and disruption will be minimal. The site may be attractive despite these obstacles because the cost of interconnection could be as low as \$28,000. It should be noted that another part of Crotched Mountain is the site of the world's first commercial wind farm which is comprised of multiple medium size (40 KW) machines. That wind farm, which was dedicated on April 24, 1981, evidences the attractiveness of the site from an institutional point of view.

A number of problems are associated with Cardigan Mountain which make it unattractive for development. A road of at least 1.3 miles would have to be constructed, the last 1/2 mile of which would be over rock. In addition, the land is managed by the New Hampshire Department of Resources and Economic Development (DRED). Its management policies are not clearly defined, but the probability that it will grant a use permit for WECS development seems low. Finally, the cost of interconnection is expected to be around \$60,000. This cost is not extremely high in comparison with other sites, but it is also not so low as to provide an incentive to development.

Cannon Mountain is also managed by DRED. For this and other reasons, it also appears unattractive. The area is extensively used for scenic and recreational purposes. Aesthetic impacts would likely be considered incompatible with many of these uses and the current uses probably would have priority in any conflict. Siting may be possible on USFS land near the summit, but it too is restricted land. Use of National Forest land may be prohibited in order to protect the land as wilderness, or to accomplish other incompatible management objectives. Interconnection with the grid would be quite inexpensive but access for construction purposes would again be a problem.

The obstacles on Moose Mountain are extensive and difficult to overcome. The land is currently privately owned, but probably will soon be transferred to the National Park Service and the Society for the Protection of New Hampshire Forests. The former will prohibit development near the Appalachian Trail; the latter will carefully scrutinize any proposal. The applicable Hanover zoning ordinance will conflict with any large-scale WECS proposal. Television interference may present a problem because of the relatively large number of residences and the two schools which are within range. In fact, because television transmitting facilities are located on the same mountain, extreme care would be required in siting. Access for construction would require about 1/2 mile of new roadway and possibly additional upgrading of existing roads. Interconnection of a large WECS could cost over a million dollars. A smaller WECS, however, could be interconnected for a considerably smaller cost.

One of the most significant problems with Wildcat Mountain is the lack of space for development. Forest Service management policies and the necessity of protecting the Appalachian Trail restrict the availability of land outside the boundary of the ski area. Development may be possible on land managed by the ski area, but acquisition of this land will require acquiescence from both the Forest Service and the ski area management. In order to get Forest Service approval, the proposal must undergo an EA which may lead to an EIS. Because Wildcat Mountain is in a particularly sensitive

aesthetic environment, aesthetic impacts will be a major issue in such evaluations. Interconnection costs are expected to be relatively high, probably exceeding \$100,000.

Other obstacles were considered for all the sites. There is a problem arising from the possibility that migratory birds could be killed by colliding with a WECS. However, insufficient data exists to assess probabilities of collision by specific species at specific sites.

Potential interference with aviation was considered for each site. There do not appear to be any conflicts which would suggest that a large WECS at any of the sites would be an obstruction. However, notice of construction will be required by the Federal Aviation Administration (FAA) at all sites.

Finally, the requirement of performing an EIS was mentioned in this summary only where development was proposed on federally owned lands. However, the reader should note that an EIS may potentially be required whenever a federal agency is involved in any manner.

6.8 LEGAL INSTITUTIONAL ISSUES - EXECUTIVE SUMMARY

This executive summary describes the legal and institutional obstacles to the development of large-scale wind energy conversion systems (WECS) in the state of New Hampshire. Such legal and institutional obstacles should not be ignored because they can defeat an otherwise technically feasible project.

The summary and the underlying report have been prepared by the Energy Law Institute of the Franklin Pierce Law Center for the University of New Hampshire (UNH) as part of an overall study for the Department of the Navy.

I. LAND USE ISSUES

This section examines the procedures and the barriers that may confront a developer seeking to use land that is either owned by the federal government, the State of New Hampshire, or a private individual.

A. Federally Owned Land

In New Hampshire, the relevant federally owned land is managed by the United States Forest Service. Use of the land is governed by the National Forest Management Act and the Federal Land Policy Management Act. Pursuant to those enabling statutes the Forest Service has promulgated regulations providing for the use of land under certain circumstances. New, more detailed regulations have been proposed, but have yet to be made final.

The use of forest service land for a WECS would be consistent with the criteria of the enabling legislation and the existing and proposed regulations, provided that the WECS will not have a highly adverse affect upon the environment and such use will not foreclose the use of the land for other purposes which have been accorded a higher priority. The right to use the land is called a "right-of-way" which can be defined as including both the WECS site and the path of the transmission facilities necessary to carry the generated electricity to its destination. Such rights-of-way may be granted via the grant of an easement or the issuance of a Special Use Permit. An easement conveys a conditioned interest in forest service land and is revocable for abandonment or non-compliance only after an administrative proceeding. A Special Use Permit provides permission, without conveying an interest in land, to occupy and use a National Forest System site. Although the permit is revocable at the discretion of an authorized officer, the Forest Service must accord the holder certain administrative rights, such as the right to notice and a hearing. Although an easement is preferable, it is difficult to obtain. It is probable that rights-of-way currently will be granted via the issuance of a Special Use Permit. The Forest Service's proposed regulations will have the effect of encouraging land use by easement. However, those regulations have yet to be made final.

Currently, an application for a special use permit, containing detailed information about the location of the proposed site and the proposed facility, must be submitted to the Chief or the Acting Chief of the Forest Service. Under the proposed rules the same procedure would be applicable to an application for an easement. The Forest Service will then conduct an Environmental Assessment and, if necessary, an Environmental Impact Statement. When this process is completed, the permit may be issued.

B. Use of State Land for WECS Development

Although many New Hampshire agencies manage state-owned land, the land suitable for WECS development will, in all probability, be managed by the Department of Resources and Economic Development (DRED). The process of obtaining the right to use state land is not as structured as that pertaining to federally owned land since no policy statutes have been adopted and no regulations have been promulgated. However, many of the same criteria will be applied to the granting of state permits even though the process will be more informal.

DRED has the authority to issue special use permits, which convey the same interest in land as the federal permits. A developer seeking such a permit must submit an application to the Commissioner of DRED. Although no written guidelines directly govern the exercise of discretion by the Commissioner, it is probable that DRED guidelines applicable to the issuance of permits for radio towers will be applied by analogy. The radio guidelines provide that adverse aesthetic impacts be minimized, that the installation comply with applicable safety codes and that the applicant must show the ability to maintain the installation. Additional guidelines may be issued by a DRED committee informally convened to consider the problem of WECS siting.

The grant of the permit may be conditioned on certain restrictions imposed by the Commissioner. Those conditions may include the right of DRED to terminate the permit at will, a "hold harmless" clause in the permit or the obligation to seek DRED approval to modify the installation. In addition, a fee may be imposed upon private developers.

C. Private Land Use

If the WECS developer does not own the site, he would be subject to whatever conditions the landowners wishes to impose. In addition, the state of New Hampshire or the municipality within which the site is located may impose additional restraints.

The most significant such restraint is the zoning power. The state of New Hampshire has delegated to cities and towns the authority to enact zoning ordinances which could limit the height of structures or the type of use to which

the land would be put. It is possible that a WECS may fail to meet such criteria.

If a WECS does fail to meet existing criteria, the developer may seek a variance. Generally, such variances may be granted if the use to which the land will be put is in the public interest, such use is based upon a unique aspect of the parcel, surrounding parcels would not suffer a diminution of value, unnecessary hardship would result from a denial of the variance and the use is not contrary to the spirit of the ordinance. Since it is probable that WECS development will be found to be in the public interest and since the parcel will have been selected because of a uniquely favorable wind regime, it appears that a WECS developer would be likely to succeed in obtaining a variance if the other conditions could be met.

D. Other Considerations

If the proposed WECS structure will be higher than 200 feet, without being shielded by natural terrain and may pose a hazard to air navigation, notice must be given to the Federal Aviation Administration (FAA) 30 days prior to construction. The FAA will then determine whether the project poses a hazard to air navigation. An adverse finding does not have any legal effect upon the project. However, if the project will be 500 feet above the highest ground elevation within a mile of the site or within an airport glide path, the State Aeronautics Commission may prohibit construction. It is unlikely that WECS development will be affected since existing WECS structures are not tall enough to be prohibited.

No other site permits are necessary to construct a WECS. Generating facilities with a capacity lower than 50 MW are exempted from the jurisdiction of the New Hampshire Site Evaluation Committee. An analysis of the statutory provisions governing the jurisdiction of the Energy Facility Evaluation Committee leads to the conclusion that it would also have no regulatory authority over a WECS because its function is to regulate facilities which produce sources of energy, such as refineries, rather than facilities which produce energy, such as WECS.

II. ENVIRONMENTAL ISSUES

A. Introduction

Over the past twenty years much legislation has been enacted at the state and federal levels to protect and enhance our environment. These laws limit the actions of the federal government, state governments, and private individuals who wish to develop land in some manner. For this study, these laws have been characterized as the National Environmental Policy Act, laws regulating the discharge of pollutants, and laws designed to protect or preserve the natural environment.

B. The National Environmental Policy Act

1. The Act

The National Environmental Policy Act (NEPA) regulates the federal government, not private individuals. Accordingly, if a federal agency wishes to construct a wind turbine or if a federal agency is somehow involved in the private construction of a wind machine, through financing or permitting, the agency must meet the requirements of the Act.

NEPA establishes a set of procedures that federal agencies must use when making decisions. It states that agencies shall develop methods by which environmental values can be incorporated into decision-making. To ensure that this goal is accomplished NEPA requires that federal agencies prepare a detailed statement prior to any recommendation or decision which may be a ". . . major federal action significantly affecting the quality of the human environment . . ." The specific content of this statement is determined by the Act. In general it must disclose the environmental impacts, both positive and negative, of the proposed action.

NEPA also created the Council on Environmental Quality (CEQ). The CEQ has recently been granted the authority to issue rules defining the NEPA procedures that all agencies must use. New regulations have become effective which state when the NEPA process must begin in the course of decision-making, which types of actions may be major Federal actions within the meaning of the Act, and how an agency shall determine whether or not a proposed decision is a major

federal action. Agencies may use their rulemaking powers to define a class of actions for which no environmental study is needed (categorical exclusions). When uncertain they may undertake an environmental assessment to determine whether or not a significant environmental impact requiring a full impact statement is likely.

The CEQ regulations are very complete in their coverage of all aspects of the NEPA process. They indicate, for example, what must be included in an environmental impact statement before it will be considered sufficient, at which stages in the process the public must be consulted and how disputes between two agencies concerned with the same project will be handled.

The CEQ regulations also mandate that other agencies adopt rules to supplement the CEQ's rules. The two federal agencies which may be involved in the development of wind power in New Hampshire, the Forest Service and the Navy, have done this. Their rules should be consulted for the specifics of their NEPA procedures.

Some states have also enacted environmental policy acts which are analogous to NEPA. New Hampshire, however, has not done this.

2. The Environmental Impacts of WECS

Large wind energy conversion systems (WECS) are likely to have several significant effects on the environment. It appears that at least environmental assessments will be required and possibly full environmental impact statements will be necessary whenever the federal government is involved in WECS construction.

WECS will have potentially significant effects on the aesthetics of the natural environment, migratory birds and television reception. Although other effects of WECS construction and operation are foreseeable, they appear to be easily overcome by careful site selection. The disruption of microwave or aircraft navigation transmissions, for example, can be avoided in this way.

C. Pollution Problems and Abatement

1. Chemical Spraying

The operation of any energy facility will require the maintenance of a transmission right-of-way. This is usually done by the spraying of herbicides.

Both federal and state laws regulate the use of such chemicals. They govern which herbicides may be used and define a certification process for those wishing to use these chemicals. WECS developers can easily escape the requirements of these laws by hiring a commercial applicator who will then be responsible for proper use of the herbicides or pesticides.

2. Noise Control

The Noise Control Act of 1972 authorized the EPA to control the noise emissions of products in commerce. To date this ACT has not been applied to WECS because of the low noise levels associated with these machines.

D. Environmental Preservation

1. Fauna and Flora

WECS developers should be aware of the Migratory Bird Treaty Act, the Endangered Species Act and the Eagle Protection laws. Penalties can be imposed on any person who "takes" a migratory bird or an eagle regardless of intent. It is uncertain how many birds will be killed by WECS operation and it is equally uncertain how the authorities will respond. The Fish and Wildlife Service and the Justice Department are responsible for enforcing these laws but will probably overlook small, isolated bird kills.

2. Land

There are three categories of federally owned land which will usually be unsuited for WECS development: wilderness areas, wild and scenic rivers, and national wildlife refuges. Various restrictions on land use accompany each of these classifications, and each of them virtually prohibits WECS development. The regulations governing wild and scenic rivers and refuges are slightly less strict and permits may be available for transmission rights-of-way. The Forest Service manages the wilderness program while the Fish and Wildlife Service directs the refuge program. Both the Department of Interior and the Department of Agriculture manage the wild and scenic rivers program.

Both federal and state laws govern development in wetlands. Federally owned wetlands may not be developed unless there is no practicable alternative and all efforts to minimize the adverse effects of construction are taken. The state wetlands protection act governs all other wetlands development in New Hampshire. Developers must notify the Water Resources Board and receive a permit or conditional permit before undertaking construction.

State and federal laws have been enacted to protect specific trails. Construction projects in the vicinity of these trails will require a permit from the Secretary of Interior for trails designated under the National Trails System Act and from the New Hampshire Department of Resources and Economic Development for the state's system of trails. Permits will allow development which does not conflict with the primary purpose of the trails which is the preservation of scenic beauty. Since the existence of a WECS can have an adverse aesthetic impact, construction in the vicinity of these trails could be prohibited.

E. Conclusion

Environmental laws should be of concern but should not be a great burden to the WECS developer. If there is a federal connection, NEPA will impose burdens on the agency rather than the developer, but NEPA is a procedural act and will not prohibit construction. Careful site selection can avoid most of the remaining environmental conflicts, for example, those associated with construction in wilderness areas, wetlands, wildlife refuges, and endangered species habitats. Conflict with the laws governing migratory birds and eagles may be inevitable but will probably not pose a significant burden. Lastly, television interference can be avoided by careful site selection and the use of television cable. The environmental barriers to WECS development will not be a burden for those sensitive to environmental needs.

III. REGULATORY ISSUE RAISED BY WECS INTERFERENCE WITH BROADCAST SIGNALS

Research has revealed that WECS operation could interfere with certain broadcast signals. It is the Federal Communications Commission (FCC) which regulates such interference pursuant to the Federal Communications Act (FCA).

The FCA and FCC regulations promulgated pursuant thereto prohibit the manufacture, sale or use of any devices capable of emitting radio frequency energy of sufficient magnitude to cause harmful interference. Since WECS interference is caused by the scattering of existing signals rather than the emission of new signals, it is unlikely that such facilities will be affected. Thus, while such interference may be a factor in an environmental evaluation, WECS would not be subject to additional regulation.

IV. MARKETING AND ENERGY CONVERSION SYSTEM POWER

A. Introduction

Because WECS power output will not always coincide with the developer's load, the question of marketing excess power and of obtaining back-up power must be considered. Two recently enacted statutes are controlling. They are Title II of the Public Utility Regulatory Policies Act of 1978 (PURPA) and the New Hampshire Limited Electrical Energy Producers Act (N.H. Act). Since PURPA and the N.H. Act are only now in the process of being implemented, their parameters have yet to be determined. However, it is clear that those statutes will assure that small independent producers can be connected to the power grid if the producer can meet certain conditions.

B. Regulation

1. The Relevant Statutes

a. PURPA

The U.S. Congress, in order to further a policy of encouraging small power producers utilizing renewable energy resources, enacted PURPA on October 14, 1978. PURPA gives the Federal Energy Regulatory Commission (FERC) the authority, subject to certain conditions, to order interconnection between qualifying small power producers and electric utilities, to order sales between qualifying small producers and utilities, and to order an electric utility to wheel the power generated by a qualifying small producer to another electric utility.

A qualifying small power producer is one who "produces electric energy solely by the use, as a primary energy source, of biomass, waste, renewable resources, or any combination thereof," has a capacity of not more than 80 MW and meets certain additional qualifying criteria to be established by FERC rulemaking pertaining to fuel use, fuel efficiency and reliability. Excluded from the definition of qualifying small power producers are municipalities and political subdivisions. It seems clear that most WECS developers would fall within the definition. The only condition which may pose problems for WECS developers is the requirement that qualifying small

power producers must meet certain reliability criteria. Regulations proposed by the FERC, but not yet finalized, ensure that WECS operators will qualify, but that varying degrees of reliability will affect the price at which WECS power may be sold.

Interconnection and the sale or exchange of electric energy between a qualifying small power producer and an electric utility may be ordered by the FERC if it finds that the order would be in the public interest and would either "encourage overall conservation of energy or capital, optimize the efficiency of use of facilities and resources, or improve reliability. In addition, the FERC must determine that such an order would not unduly burden the utility, unreasonably impair the utility's ability to provide adequate service or result in a "reasonably ascertainable uncompensated economic loss" to the utility. In view of the Congressional policy of encouraging small power production, it is likely that a WECS developer would be able to meet the criteria for interconnection and the sale or exchange of electric energy.

If the purchaser of power from a small producer is not the franchised utility serving the area where the WECS is located, such a purchaser can seek to have the power wheeled through the transmission facilities of that franchised utility. The FERC can order such wheeling, subject to the findings necessary to order interconnection. However, a more stringent assessment will be made of the value of a wheeling order. In addition to the interconnection criteria, the FERC must determine that a wheeling order will preserve existing competitive relationships, the electricity provided will not replace power currently provided under contract or utility rate schedules and that the transmittal will not be to a retail consumer.

b. The New Hampshire Act

The New Hampshire Act provides similar interconnection and wheeling guarantees as PURPA. However, it only applies to electrical producers not using nuclear or fossil fuels which have a capacity not greater than 5 MW. Unlike PURPA, the definition does not exclude municipalities and political subdivisions. It is clear that a WECS operator would qualify so long as capacity did not exceed the 5 MW limit.

After exempting small power producers from all rules, regulations and statutes applicable to public utilities, the New Hampshire Act provides that the entire output of such producers, if offered for sale, must be purchased by the franchised electric utility serving the area where the producer is located, at a price to be set by the New Hampshire Public Utilities Commission (PUC). However, the electric utility will not be required to purchase a small producer's entire output if it exceeds 10% of the utility's gross sales of electricity. The PUC has set a price of 8.2 cents/KWH for power which displaces capacity. The 7.7 cents/KWH price would be applicable to WECS. Those prices are subject to change.

The New Hampshire Act also has a wheeling provision. A small power producer may sell power to not more than three purchasers other than the franchised electric utility, even if those purchasers are retail consumers. The electric utility can then be compelled by the PUC to wheel that power through its transmission system to those purchasers. This can be distinguished from PURPA which prohibits similar FERC orders where the purchaser is a retail consumer. In order to issue a wheeling order, the PUC must find that it is not likely to result in a reasonably ascertainable uncompensated loss, will not unduly burden any party to the transaction, will not unreasonably impair the reliability of the wheeling utility and will not impair the ability of the wheeling utility to render adequate service.

2. The Relationship of the State and Federal Statutes: Pre-emption

Pre-emption is the term that describes the ability of the law of one sovereign to take precedence over the law of a lesser sovereign. In the context of this report, it is the supremacy of the federal law (PURPA) to the New Hampshire Act, a state law.

Generally, the pre-emption doctrine will not be applicable unless the federal measure is within the area of authority of the federal government. Since PURPA is within the scope of federal authority, it must be ascertained whether pre-emption exists. Generally, pre-emption will not be deemed to exist unless: (1) exhaustive legislation leads to the inference that Congress intended to pre-empt state law, (2) a court finds that the legislation is addressed to a

concern requiring national uniform standards, or (3) the federal and state laws are contradictory, making compliance with both impossible.

From the above standards it can be concluded that, for the most part, the New Hampshire Act would not be pre-empted by PURPA. Congress did not manifest an intent to set up a comprehensive program pre-empting the field, PURPA does not contain the type of regulatory authority requiring national uniformity and the state and federal legislation do not conflict in any important respects.

The one area of conflict that raises a pre-emption question is the provision in the New Hampshire Act limiting the right of the small producer to sell its entire output to the franchised electric utility when the sale would exceed 10% of the utility's gross electrical sales. This is the one provision that is more restrictive than the relevant federal legislation. Because Congress manifested its intent to encourage small power production, it can be concluded that PURPA sets forth the minimum restrictions that may be placed upon such a small power producer. The states are free to legislate less restrictive measures. Since the "10%" provision of the New Hampshire Act is more restrictive than PURPA, and apparently in direct conflict with the federal legislation, it is likely that it will be required to give way to federal requirements that a small power producer's entire output be accepted, if other federal conditions are satisfied.

C. Economic Analysis

This section addresses the parameters of the rates that may be established for power purchased from WECS producers. The general definition of the ratesetting methodology is clear. As described in PURPA and the proposed FERC regulations the rates must be based upon the incremental or avoided cost to the electrical utility which is purchasing the power. This has been defined as the cost to the utility of the electric energy which, but for the purchase from the small power producer, such utility would generate or purchase from another source.

This definition is ambiguous and it involves examination of three variables: (1) the load characteristics of the utility at the time of the purchase; (2) the reliability of the WECS; and (3) a combination of the above two factors as they relate to the ability of the WECS producer to supply "firm" power and thereby offset capacity.

The PUC grappled with these issues in its attempt to set rates for small power producers pursuant to the New Hampshire Act. It found that the supply of "firm" power has a capacity value over and above the value in fuel savings. Thus, two rates were established. The first rate of 8.2 cents/KWH is applicable when the power will offset capacity. The other rate of 7.7 cents/KWH is applicable when the power only offers the utility savings in fuel. Until the reliability of WECS can be effectively demonstrated, it is probable that such power will only be eligible for the 7.7 cents/KWH rate. The PUC noted that the rates are subject to change as more information becomes available.

FOOTNOTES

- 1 U.S. CONST. art. VI, cl. 2.
- 2 McCulloch v. Maryland, 17 U.S. (4 Wheat) 316 (1819).
- 3 U.S. CONST. art. IV, § 3.
- 4 National Environmental Policy Act, 42 U.S.C. § 4321 (1976).
- 5 An exception to this rule arises in the case of lands administered by the Bureau of Land Management (BLM) which frequently allows private individuals access to the land for use.
- 6 National Forest Management Act, 16 U.S.C. § 1601-1614 (1976).
- 7 National Environmental Policy Act, 42 U.S.C. § 4321 (1976).
- 8 43 U.S.C. § 1701 et. seq. (1976).
- 9 (1976) U.S. CODE CONG. & AD. NEWS 6175.
- 10 16 U.S.C. § 528.
- 11 17 U.S.C. § 1701 et. seq.
- 12 Id.
- 13 43 U.S.C. § 1732 Private developers may have use authorized under terms and conditions prescribed by the secretary which are consistent with applicable law.
- 14 16 U.S.C. § 497 (1976).
- 15 Id.
- 16 National Forest System Lands: Special Use Permits, 36 C.F.R. § 251.1 et. seq.
- 17 National Forest System Lands: Special Uses: 44 Fed. Reg. 29107 (1979) (to be codified at 36 C.F.R. § 251).
- 18 44 Fed. Reg. 29107, 29115 (1979) (to be codified at 36 C.F.R. § 251.50).
- 19 36 C.F.R. § 211.19 (1978).
- 20 Supra n. 18.
- 21 36 C.F.R. § 251.52 (1978).
- 22 Supra n. 17.
- 23 Forest Service Manual § 2710-1--1 (May 10, 1979. The directive goes on to cite the Act of October 21, 1976, P.L. 94-579 as its authority).

- 24 These differing positions were revealed in a telephone conversation with W. VanDoran in the D.C. Lands Staff Office, (Sept. 27, 1979), and an interview with Dale Gorman, the Deputy Forest Supervisor of the White Mountain National Forest, (Oct. 3, 1979).
- 25 44 Fed. Reg. 29103, 29115 (1979) (to be codified at 36 C.F.R. § 251.50).
- 26 Id. at subsection (i)(4).
- 27 36 C.F.R. § 251.52 (1978).
- 28 36 C.F.R. § 251.55 (1978).
- 29 36 C.F.R. § 251.57 (1978). Language of the first part of these rules refers to easements. The section on free use refers to permits. The forest service did not intend thereby to distinguish between the rates to be charged for easements as opposed to permits. This interpretation is based on a telephone conversation November 14, 1979 with Mr. Boring, USDA lands staff.
- 30 36 C.F.R. § 25.12 (1978).
- 31 44 Fed. Reg. 29116 (1979) (to be codified 36 C.F.R. § 251.54).
- 32 Id.
- 33 44 Fed. Reg. 29120 (1979) (to be codified 36 C.F.R. § 251.57).
- 34 43 U.S.C. § 1734.
- 35 See Section II, infra.
- 36 Public Utility Holding Company Act of 1935, 49 Stat. 840.
- 37 Chemehuevi Tribe of Indians v. Federal Power Commission, 420 U.S. 395 (1975).
- 38 16 U.S.C. § 824.
- 39 Id.
- 40 36 C.F.R. § 251.52 (1978).
- 41 16 U.S.C. § 497.
- 42 36 C.F.R. § 251.52 (1978).
- 43 Id.
- 44 36 C.F.R. § 251.58 (1978).

- 45 36 C.F.R. § 251.60 (1978).
- 46 36 C.F.R. § 251.61 (1978).
- 47 36 C.F.R. § 251.62 (1978).
- 48 36 C.F.R. § 251.64 (1978).
- 49 State Owned Real Property, Eighth Biennial Report (1976-1977)
(Report of Department of Administration and Control as required
by N.H. RSA 8:5).
- 50 N.H. Rev. Stat. Ann. § 218.5.
- 51 Id.
- 52 Id.
- 53 State Land Use for Radio and Television Sites, etc. (1964) (on file
with the Office of Administrative Procedure).
- 54 Id.
- 55 Telephone conversation with Jack Sargent, Supervisor of the Forest
Fire Service, DRED (Oct. 17, 1979).
- 56 Village of Euclid v. Ambler Realty Co., 272 U.S. 365, 47 S.Ct. 114,
71 L.Ed. 303 (1926).
- 57 N.H. Rev. Stat. Ann. § 31:60 (1970).
- 58 Id.
- 59 N.H. Rev. Stat. Ann. § 31:62 (1970).
- 60 Generally N.H. Rev. Stat. Ann. § 31 (as amended Supp. 1977).
- 61 United States Constitution, 5th Amend.
- 62 New Hampshire Constitution Pt. 1, Art. 12.
- 63 See generally cases cited in 82 Am. Jur. 2d. Zoning & Planning § 13
(1976).
- 64 Supra n. 60.
- 65 N.H. Rev. Stat. Ann. § 31:63b (1910)
- 66 Edgewood Civic Club v. Blaisdell, 95 N.H. 244, 246, 61 A.2d 517 (1948).
- 67 Schadlick v. Concord, 108 N.H. 319, 234 A.2d 523 (1967).

- 68 N.H. Rev. Stat. Ann. § 31:66-77 (as amended Supp. 1977).
69 114 N.H. 491, 322 A.2d 608 (1974).
70 Carter v. City of Nashua, 113 N.H. 407, 419, A.2d 487 (1973).
71 For example, see Carter v. City of Nashua, supra n. 70.
72 N.H. Rev. Stat. Ann. § 31:77 (1970).
73 N.H. Rev. Stat. Ann. § 31:78 (1970).
74 N.H. Rev. Stat. Ann. § 36-C (Supp. 1977).
75 N.H. Rev. Stat. Ann. § 31:89.
76 Id. See also section II D 3 infra.
77 N.H. Rev. Stat. Ann. § 31:110.
78 Id.
79 N.H. Rev. Stat. Ann. § 31:112.
80 Id.
81 Id.
82 N.H. Rev. Stat. Ann. § 31:114.
83 14 C.F.R. § 77.13 (1979).
84 Id.
85 14 C.F.R. § 77.23 (1979).
86 The proper form for this notice is FAA's Form # 7460-a.
87 14 C.F.R. § 77.35 (1979).
88 Id.
89 Airline Pilots Assn. v. Dept. of Transportation, FAA, 446 F.2d 236,
240 (5th Cir. 1971).
90 Id.
91 N.H. Rev. Stat. Ann. § 422:11.
92 N.H. Rev. Stat. Ann. § 424:3.

- 93 N.H. Rev. Stat. Ann. § 162-F:6.
- 94 N.H. Rev. Stat. Ann. § 162-F:3.
- 95 N.H. Rev. Stat. Ann. § 162-F:2I.
- 96 N.H. Rev. Stat. Ann. § 162-H:4.
- 97 N.H. Rev. Stat. Ann. § 162-H:2 IV.
- 98 It is this exclusion which raises the question of whether facilities of less than 50 MW are within the definition of "energy facility" because they are no longer subject to the excluding reference to "bulk power supply facilities."
- 99 N.H. Rev. Stat. Ann. § 162-H:3.
- 100 2A Sutherland, Statutory Construction § 47.17 (4th Ed. 1973).
- 101 The one opinion construing that statute was State v. Dorsey, ___ N.H. ___, 395 A.2d 855 (1978). There, a demonstrator arrested at the Seabrook nuclear facility asserted a defense that the facility represented a danger to the public health and safety. The court stated that the legislature made a deliberate choice regarding nuclear power by creating the EFEC to determine whether a site will unduly interfere with public health or safety, citing N.H. Rev. Stat. Ann. § 162-H:1 et. seq. This part of the opinion is erroneous on its face. The Seabrook facility is clearly and unambiguously a "bulk power supply facility" as defined in N.H. Rev. Stat. Ann. § 162-F:2I and, as such, it is subject to the jurisdiction of the Site Evaluation Committee. It is specifically excluded from the definition of an "energy facility" subject to the jurisdiction of the EFEC.
- 102 42 U.S.C. § 4321 (1970) et. seq.
- 103 42 U.S.C. § 4331 (1970).
- 104 42 U.S.C. § 4332 (1970).
- 105 42 U.S.C. § 4332 (c) (1970).
- 106 42 U.S.C. §§ 4342 - 4346 (1970).
- 107 42 U.S.C. § 4344 (3) (1970).
- 108 Executive Order No. 11,514, 3 C.F.R. § 285 (1973) reprinted in 42 U.S.C. § 4321 (1970).
- 109 Supra n. 105.
- 110 40 C.F.R. § 1500 (1978) et. seq.

- 111 Sierra Club v. Lynn, 502 F.2d 43 (5th Cir. 1974) cert. den. 421 U.S. 994 (1974).
- 112 Executive Order No. 11,991, 3 C.F.R. § 123 (1978).
- 113 43 Fed. Reg. 55,990 (1978) (to be codified 40 C.F.R. § 1500-1508).
- 114 43 Fed. Reg. 55,992 (1978) (to be codified 40 C.F.R. § 1501.2).
- 115 42 U.S.C. § 4332 (A) (1970), and Supra n. 114.
- 116 Supra n. 113.
- 117 43 Fed. Reg. 56,003 (1978) (to be codified 40 C.F.R. § 1507.3).
- 118 43 Fed. Reg. 56,003 (1978) (to be codified 40 C.F.R. § 1508.4).
- 119 Supra n. 105.
- 120 Supra n. 114.
- 121 43 Fed. Reg. 55,992 (1978) (to be codified 40 C.F.R. § 1501.4).
- 122 Supra n. 105.
- 123 E.g., Scherr v. Volpe, 466 F.2d 1027 (7th Cir. 1972).
- 124 E.g., Minnesota Public Interest Research Group v. Butz, 498 F.2d 1314 (8th Cir. 1974).
- 125 43 Fed. Reg. 56,004 (1978) (to be codified 40 C.F.R. § 1508.18).
- 126 Supra n. 125. A variety of actions have been categorically excluded, however. For example, the Department of Agriculture has excluded budget proposals and law enforcement activities from the NEPA process. 44 Fed. Reg. 44,802 (1979) (to be codified 7 C.F.R. § 3100.22).
- 127 43 Fed. Reg. 56,004 (1978) (to be codified 40 C.F.R. § 1508.14).
- 128 Supra n. 124 at 1322.
- 129 43 Fed. Reg. 56,004 (1978) (to be codified 40 C.F.R. § 1508.8).
- 130 Supra n. 129.
- 131 43 Fed. Reg. 56,005 (1978) (to be codified 40 C.F.R. § 1508.27).
- 132 Supra n. 131.
- 133 For a general review of cases on this question see Rodgers, Environmental Law 756-61 (1977).

- 134 43 Fed. Reg. 55,994 (1978) (to be codified 40 C.F.R. § 1502).
- 135 For environmental cases using this standard see First National Bank of Chicago v. Richardson, 471 F.2d 1369 (7th Cir. 1973) and Hanly v. Kleindienst, 484 F.2d 823 (2nd Cir. 1972).
- 136 Minnesota Public Interest Research Group v. Butz, 498 F.2d 1314 (8th Cir. 1974). Wyoming Outdoor Coordination Council v. Butz, 484 F.2d 1284 (10th Cir. 1973). Save Our Ten Acres v. Kreger, 472 F.2d 463 (5th Cir. 1973).
- 137 Mount Vernon Preservation Society v. Clements, 415 F. Supp. 141 (D. N.H. 1975), Essex County Preservation Assn. v. Campbell, 399 F. Supp. 208 (D. Mass. 1975), Rhode Island Committee on Energy v. G.S.A., 397 F. Supp. 41 (D.R.I. 1975).
- 138 43 Fed. Reg. 56,004 (1978) (to be codified 40 C.F.R. § 1508.16).
- 139 43 Fed. Reg. 55,994 (1978) (to be codified 40 C.F.R. § 1501.8).
- 140 43 Fed. Reg. 55,991 (1978) (to be codified 40 C.F.R. § 1500.4).
- 141 For example a FONSI supra n. 118.
- 142 43 Fed. Reg. 55,997 (1978) (to be codified 40 C.F.R. § 1503).
- 143 43 Fed. Reg. 56,003 (1978) (to be codified 40 C.F.R. § 1507.3).
- 144 Department of Agriculture - 44 Fed. Reg. 44,802 (1979) (to be codified 7 C.F.R. § 3100); Department of Defense - 32 C.F.R. § 214 (1978).
- 145 44 Fed. Reg. 44,720 (1979) (to be published Forest Service Manual § 1950 et. seq.).
- 146 44 Fed. Reg. 44,802 (1979) (to be codified 7 C.F.R. § 3100.20).
- 147 32 C.F.R. § 214.2 (1974).
- 148 44 Fed. Reg. 44,802 (1979) (to be codified 7 C.F.R. § 3100.22).
- 149 44 Fed. Reg. 44,737 (1979) Exhibit I.
- 150 SRI International, A Feasibility Study of Windpower for the New England Area, 115 (October, 1979).
- 151 Supra n. 150 at 126.
- 152 Rodgers, S.E., "Wind Energy Conversion-Environmental Effects Assessment" in Third Wind Energy Workshop 401 (1977).

- 153 Supra n. 129.
- 154 Supra n. 150 at 113.
- 155 Maryland-National Capital Park and Planning Commission v. U.S. Postal Service, 487 F.2d 1029 (D.C. Cir. 1973).
- 156 Supra n. 131.
- 157 Rucker v. Willis, 484 F.2d 158, 162 (4th Cir. 1973).
- 158 Supra n. 150 at 127-129.
- 159 Supra n. 150 at 128-129.
- 160 Supra n. 152 at 403.
- 161 Supra n. 150 at 119.
- 162 Supra n. 150 at 124.
- 163 Supra n. 150 at 125.
- 164 Supra n. 150 at 126.
- 165 Supra n. 150 at 126.
- 166 Supra n. 150 at 122.
- 167 Supra n. 150 at 120.
- 168 Supra n. 150 at 123.
- 169 Supra n. 152 at 411.
- 170 Supra n. 152 at 412.
- 171 U.S. Department of Energy, "Wind Turbine Generator System, Block Island, Rhode Island - Final Environmental Impact Statement," DOE/EIS-0006 (1978).
- 172 Supra n. 139 and 140.
- 173 U.S.C.A. § 135 (1964) (as amended West Cum. Supp. 1964-79).
- 174 N.H. Rev. Stat. Ann. § 438 (1968) (as amended Supp. 1968-77).
- 175 7 U.S.C.A. § 135 (a)(2) (West Cum. Supp. 1979) and identical language in N.H. Rev. Stat. Ann. § 438:1-I(b) (Supp. 1977).
- 176 7 U.S.C.A. § 136 (West Cum. Supp. 1979).

- 177 N.H. Rev. Stat. Ann. § 149-D (1977) (as amended Supp. 1977).
- 178 7 U.S.C.A. § 136 (u) (West Cum. Supp. 1979).
- 179 7 U.S.C.A. § 136a (d) (West Cum. Supp. 1979).
- 180 7 U.S.C.A. § 136b (West Cum. Supp. 1979). Herbicides may be considered as equivalent to pesticides for the purposes of this discussion.
- 181 Supra n. 180.
- 182 N.H. Rev. Stat. Ann. § 149-D:3 (III) (Supp. 1979).
- 183 N.H. Rev. Stat. Ann. § 149-D:3 (II) (1977).
- 184 N.H. Rev. Stat. Ann. § 149-F:4 (Supp. 1977).
- 185 Supra n. 184.
- 186 Supra n. 184.
- 187 N.H. Rev. Stat. Ann. § 149-D:9 (III) (Supp. 1977).
- 188 N.H. Rev. Stat. Ann. § 149-D:3 (XI) (Supp. 1977).
- 189 42 U.S.C. § 4901 et. seq. (1976).
- 190 42 U.S.C. § 4904 (1976).
- 191 42 U.S.C. § 4905 (1976).
- 192 42 U.S.C. § 4905(a)(i)(c) (1976).
- 193 Supra n. 191.
- 194 See generally 40 C.F.R. § 201-210 (1978).
- 195 40 C.F.R. § 204 (1978).
- 196 N.H. Rev. Stat. Ann. § 47:17 XIV (1970).
- 197 16 U.S.C. § 590(a) et. seq. (1976), 16 U.S.C. 2001 et. seq. (Supp. I 1977), 7 C.F.R. 600 et. seq. (1979), N.H. Rev. Stat. Ann. §§ 430-A, 430-B (1968).
- 198 N.H. Rev. Stat. Ann. § 430-B (1968).
- 199 N.H. Rev. Stat. Ann. § 430-B:9 (1968).
- 200 42 U.S.C. § 7401 et. seq. (Supp. I 1977).

- 201 42 U.S.C. § 7521 et. seq. (Supp. I 1977).
- 202 33 U.S.C. § 1251 et. seq. (1976) (as amended Supp. I 1977).
- 203 N.H. Rev. Stat. Ann. § 249-B (1977) (as amended Supp. 1977).
- 204 42 U.S.C. § 1363 (14) (1976).
- 205 16 U.S.C.A. § 701 et. seq. (1974) (as amended Supp. 1974-79).
- 206 N.H. Rev. Stat. Ann. § 209 (1977).
- 207 16 U.S.C.A. § 703 (1974) and N.H. Rev. Stat. Ann. § 209:6 (1977).
- 208 16 U.S.C.A. § 707 (1974).
- 209 U.S. v. Ireland, 493 F.2d 1208 (4th Cir. 1974).
- 210 50 C.F.R. § 10 (1978).
- 211 16 U.S.C.A. § 704 (1974).
- 212 50 C.F.R. §§ 13, 20, 21 (1978).
- 213 16 U.S.C.A. § 1531 et. seq. (1974) (as amended West Cum. Supp. 1974-1979).
- 214 16 U.S.C.A. § 1538 (West Cum. Supp. 1979).
- 215 16 U.S.C.A. § 1532 (6) (West Cum. Supp. 1979).
- 216 16 U.S.C.A. § 1533 (West Cum. Supp. 1979).
- 217 50 C.F.R. § 17 (1978).
- 218 16 U.S.C.A. § 1540 (West Cum. Supp. 1979).
- 219 16 U.S.C.A. § 1532 (5) (West Cum. Supp. 1979).
- 220 50 C.F.R. § 17.95 (1978).
- 221 16 U.S.C.A. § 1536 (West Cum. Supp. 1979).
- 222 Supra n. 221.
- 223 16 U.S.C.A. § 1536 (West Cum. Supp. 1979).
- 224 16 U.S.C.A. § 1536(h) (West Cum. Supp. 1979).
- 225 Chapter 356 N.H. Laws (1979) (to be codified N.H. Rev. Stat. Ann. § 212-A).

- 226 16 U.S.C. § 668 (1976) and N.H. Rev. Stat. Ann. § 209:9 (Supp. 1977).
- 227 16 U.S.C. § 668 (1976).
- 228 50 C.F.R. §§ 13, 22 (1978).
- 229 16 U.S.C. § 661 et. seq. (1976).
- 230 N.H. Rev. Stat. Ann. § 207 et. seq. (1977) (as amended Supp. 1977).
- 231 16 U.S.C.A. § 1121 et. seq. (1974) (as amended West Cum. Supp. 1974-1979).
- 232 16 U.S.C.A. § 1132 (West Cum. Supp. 1979).
- 233 Supra n. 232.
- 234 16 U.S.C.A. § 1133 (1974).
- 235 36 C.F.R. § 293 (1978).
- 236 16 U.S.C.A. § 1133(d)(4) (1974).
- 237 16 U.S.C.A. § 1271 et. seq. (1974) (as amended West Cum. Supp. 1974-79).
- 238 16 U.S.C.A. § 1273(b) (1974).
- 239 16 U.S.C.A. § 1287(a) (West Cum. Supp. 1979).
- 240 16 U.S.C.A. § 1277(a) (1974).
- 241 16 U.S.C.A. §§ 1274, 1276 (West Cum. Supp. 1979).
- 242 16 U.S.C.A. § 1281(a) (1974).
- 243 See the Water Bank Act 16 U.S.C. § 1202 et. seq. (1970). The Coastal Zone Management Act of 1972, 16 U.S.C.A. 1451 et. seq. (1974) (as amended West Cum. Supp. 1974-1979), is being ignored for purposes of this study.
- 244 Executive Order No. 11988, 3 C.F.R. 117 (1978) reprinted in 42 U.S.C.A. § 4321 (West Cum. Supp. 1979).
- 245 Executive Order No. 11990, 3 C.F.R. 121 (1978) reprinted in 42 U.S.C.A. § 4321 (West Cum. Supp. 1979).
- 246 Supra n. 244, § 2.
- 247 Supra n. 246.
- 248 Supra n. 245, § 2.

- 249 Supra n. 245, § 2.
- 250 N.H. Rev. Stat. Ann. § 483-A (Supp. 1977).
- 251 N.H. Rev. Stat. Ann. § 483-A:1 (Supp. 1977).
- 252 N.H. Rev. Stat. Ann. § 483-A:3 (Supp. 1977).
- 253 N.H. Rev. Stat. Ann. § 483-A:6 (Supp. 1977).
- 254 N.H. Rev. Stat. Ann. § 431 (1968).
- 255 N.H. Rev. Stat. Ann. § 36-A:4 (Supp. 1977).
- 256 Supra n. 251.
- 257 16 U.S.C.A. § 668dd et. seq. (1974) (as amended West Cum. Supp. 1974-1979).
- 258 16 U.S.C.A. § 668dd (a) (West Cum. Supp. 1979).
- 259 16 U.S.C.A. § 668dd (d) (West Cum. Supp. 1979).
- 260 N.H. Rev. Stat. Ann. § 212:10 (1977).
- 261 N.H. Rev. Stat. Ann. § 212:10 (1977).
- 262 16 U.S.C.A. § 1241 et. seq. (1974) (as amended West Cum. Supp. 1974-1979).
- 263 16 U.S.C.A. § 1245 (West Cum. Supp. 1979).
- 264 16 U.S.C.A. § 1246 (c) (West Cum. Supp. 1979).
- 265 N.H. Rev. Stat. Ann. § 216-F (1977).
- 266 N.H. Rev. Stat. Ann. § 216-F:1 (1977).
- 267 N.H. Rev. Stat. Ann. § 216-F:2 (1977).
- 268 Supra n. 262.
- 269 16 U.S.C.A. § 461 et. seq. (1974) (as amended West Cum. Supp. 1974-78).
- 270 16 U.S.C.A. § 469a-1 (1974).
- 271 16 U.S.C.A. § 469a-2 (1974).
- 272 Supra n. 271.
- 273 16 U.S.C.A. § 470 (1974) (as amended West Cum. Supp. 1974-79).

- 274 16 U.S.C.A. § 470a (1974) (as amended West Cum. Supp. 1979).
- 275 16 U.S.C.A. § 470f (West Cum. Supp. 1979).
- 276 N.H. Rev. Stat. Ann. § 227-c (1977).
- 277 N.H. Rev. Stat. Ann. § 227-c:5 (1977).
- 278 N.H. Rev. Stat. Ann. § 227-c:6 (1977).
- 279 N.H. Rev. Stat. Ann. § 227-c:7 (1977).
- 280 36 C.F.R. § 800.2 (1978).
- 281 44 Fed. Reg. 7525 (1979).
- 282 47 U.S.C. § 151, et. seq.; 48 Stat. 1064 (June 19, 1934).
- 283 47 U.S.C. § 151.
- 284 Id.
- 285 47 U.S.C. § 152.
- 286 47 U.S.C. § 153 (b)
- 287 Id.
- 288 Allen B. Dumont Laboratories v. Carroll, 184 F.2d 153 (3rd Cir. 1950) cert. denied 340 U.S. 929, and Stoddard Radio and Television v. Chronicle Publishing Co. 6 Cal. Rptr. 246 (1960).
- 289 47 U.S.C. 302a, Publ. L. 90-379.
- 290 1968 Code Cong. and Adm. News 2486.
- 291 Id. at 2488.
- 292 47 C.F.R. § 15.4 (a) (1978).
- 293 Proceedings of the Third Biennial Conference and Workshop on Wind Energy Conversion Systems, 9/19-21/1977 for U.S. DOE, Electro-magnetic Interference to Television Reception Caused by Windmills, D. L. Sengupta and T.B.A. Senior, University of Michigan Dept. of Electrical and Computer Engineering, Ann Arbor, Michigan. (Emphasis added).
- 294 In fact, the FCC does not regulate devices which cause interference by scattering existing signals. Only devices which cause interference by emitting radio frequency energy, as defined in the regulations, are subject to such regulation. Telephone interview with Vincent Kajunski, Engineer in Charge, FCC Engineering and Enforcement, Boston, November 29, 1979.

- 295 92 Stat. 3117, Pub. L. 95-617.
- 296 N.H. Rev. Stat. Ann. § 362-A.
- 297 16 U.S.C. § 824(i).
- 298 16 U.S.C. § 824(j).
- 299 16 U.S.C. § 824(k).
- 300 Part I of the FPA, which contains the licensing power of the Commission does not extend to any power producing facilities other than hydroelectric dams. Federal jurisdiction of licensing is based on the constitutional power of Congress to regulate "navigable" streams and interstate commerce and not on any notion of the regulation of power production. With the enactment of the Public Utility Holding Company Act of 1935, the licensing provisions of the original Federal Water Power Act were clearly distinguished from the regulation of rates by means of the Part headings. The relevant portions of PURPA were enacted as amendments to Part II of the FPA, concerning rate regulation, and no changes were made in Part I (Licensing) to suggest the extension of FERC licensing jurisdiction to any other area. Thus, it seems clear that PURPA does not contemplate the exercise of FERC jurisdiction over licensing or any other permit process for the siting and construction of WECS.
- 301 16 U.S.C. 824 a-3.
- 302 Federal Water Power Act, ch. 285, 41 Stat. 1063 (1920).
- 303 Id., § 1.
- 304 Id., § 4 a-h.
- 305 U.S. Government Organization Manual, 1953-54 at 367-68.
- 306 Public Utility Holding Company Act, August 26, 1935, ch. 687, Title I, 49 Stat. 803 (15 U.S.C. §§ 79-79(s)(6)); and, Federal Power Act, August 26, 1935, ch. 687, Title II, 49 Stat. 838 (scattered in 16 U.S.C. §§ 791-825(r)).
- 307 Id. at Part II.
- 308 Act of August 4, 1977, Pub. L. No. 95-91, 91 Stat. 565.
- 309 376 U.S. 205 (1964).
- 310 404 U.S. 453 (1972).
- 311 16 U.S.C. § 824 a (b).
- 312 402 U.S. 515 (1971).

- 313 City of Paris, 41 FPC 45 (1969).
- 314 410 U.S. 366, 382 (1973).
- 315 FPC v. Idaho Power Co., 344 U.S. 17 (1952).
- 316 Utah Power and Light Co. v. Morton, 504 F.2d 728 (9th Cir. 1974).
See also the discussion of federal authority over transmission lines traversing federal lands, supra, Section I.
- 317 FPA, § 201 (9), 16 U.S.C. § 824 (a).
- 318 FPC v. Southern California Edison, 376 U.S. 205 (1964).
- 319 U.S. CONST. art. I, § 8.
- 320 FPC v. Southern California Edison, supra n. 318.
- 321 FPA, § 3 (17)(A), 16 U.S.C. § 796 (17)(A).
- 322 FPA, § 3 (17)(C), 16 U.S.C. § 796 (17)(C).
- 323 FPA, § 3 (17)(D), 16 U.S.C. § 796 (17)(D).
- 324 FPA, § 3 (22), 16 U.S.C. § 796 (22).
- 325 FPA, § 3 (17)(A)(i), 16 U.S.C. § 796 (A)(i)
- 326 FPA, § 3 (17)(A)(ii), 16 U.S.C. § 796 (A)(ii).
- 327 The Act provides that the 80 MW ceiling applies to small facilities" . . . together with any other facilities located at the same site . . ." The FERC is responsible for determining what constitutes a single site.
- 328 FPA, § 3, (17)(C)(i), 16 U.S.C. § 796, (17)(C)(i).
- 329 The reliability issue is discussed more thoroughly in IV C, Economics. The statutory requirements are set out in § 209 of PURPA, "Reliability."
- 330 The relevant definition of "person," contained in the FPA, 16 U.S.C. § 796 (3) and (4), defines person as an individual or corporation, and then specifically excludes municipalities from the definition of corporation. Consequently, municipalities are not eligible to own qualifying facilities.
- 331 FPA § 3 (17)(C)(ii), 16 U.S.C. § 796 (17)(C)(ii).
- 332 FPA, § 3 (22), 16 U.S.C. § 796 (22). The term includes the TVA but does not include any federal power marketing agency.
- 333 44 Fed. Reg. 38872, (1979) (to be codified 18 C.F.R. Part 292).

334 10 KW minimum and 80 MW maximum.

335 FPA, § 210 (a)(1)(A).

336 FPA, § 210 (a)(1)(C).

337 FPA, § 210 (c)(1).

338 FPA, § 210 (c)(2)(A).

339 FPA, § 210 (c)(2)(B).

340 FPA, § 210 (c)(2)(C).

341 Section 212 is discussed infra at 70.

342 FPA, § 211 (a)(1).

343 FPA, § 211 (a)(2)(A).

344 FPA, § 211 (a)(2)(B).

345 FPA, § 211 (a)(2)(C).

346 FPA, § 211 (a)(3).

347 FPA, § 211 (c)(1).

348 FPA, § 211 (c)(2).

349 FPA, § 211 (c)(4).

350 FPA, § 212 (a)(2).

351 FPA, § 212 (a)(3).

352 FPA, § 212 (a)(4).

353 FPA, § 212 (a)(1).

354 PURPA, § 210 (a).

355 PURPA, § 210 (a)(1).

356 PURPA, § 210 (a)(2).

357 PURPA, § 210 (a). In this regard, note the discussion in the following subsection on N.H. Rev. Stat. Ann. 362-A:2-9 relative to wheeling.

358 These pricing aspects are discussed in Section IV D, infra, regarding the economics of such sales.

- 359 Note that N.H. Rev. Stat. Ann. § 362-A (discussed in Section IV B (1)(b)) exempts small electrical producers, including WECS, from all such regulation generally applicable to electric utilities.
- 360 44 Fed. Reg. 38,863 (1979).
- 361 Id. at 38,864.
- 362 Id.
- 363 44 Fed. Reg. 61190 (1979) (to be codified 18 C.F.R. Part 292).
- 364 N.H. Rev. Stat. Ann. § 362-A (August 22, 1978).
- 365 N.H. Rev. Stat. Ann. § 362-A:1.
- 366 N.H. Rev. Stat. Ann. § 362-A:2.
- 367 Id.
- 368 N.H. Rev. Stat. Ann. § 362-A:4. An electric utility will not be required to purchase a small producer's entire output if the amount of the potential purchase is greater than 10% of the utility's gross sales of electricity.
- 369 N.H. Rev. Stat. Ann. § 362-A:5.
- 370 Id.
- 371 N.H. PUC, Order No. 13,589 (April 18, 1979).
- 372 N.H. PUC, Doc. No. 79-208; Order No. 14,280, June 18, 1980. The final regulations were published in 45 Fed. Reg. 12214 et. seq. (February 25, 1980) (to be codified 18 C.F.R. 292.101 et. seq.).
- 373 44 Fed. Reg. 38,864 (1979).
- 374 1979 N.H. Laws, ch. 411 (August 22, 1979).
- 375 N.H. Rev. Stat. Ann. § 362-A:2-a II, added by 1979 N.H. Laws, ch. 411:1.
- 376 Supra n. 371.
- 377 Id.
- 378 Id.
- 379 Id.
- 380 N.H. Rev. Stat. Ann. § 362-A:2(a) III, added by 1979 N.H. Laws, ch. 411:1.

- 381 Adapted from Energy Law Institute, Legal Obstacles and Incentives to the Development of Small Scale Hydroelectric Power in Pennsylvania, August 14, 1979.
- 382 United States Constitution, Art. I, § 8.
- 383 United States Constitution, Art. IV, § 2.
- 384 See McCulloch v. Maryland, 17 U.S. (4 Wheat) 316, 405 (1819), (" . . . [G]overnment of the Union though limited in its power is supreme within its sphere of action.")
- 385 See e.g., Regents v. Carroll, 338 U.S. 586 (1950), where the Court held that the FCC could, pursuant to the federal power of regulating interstate commerce, grant or deny or condition the grant of a radio broadcasting license. Here, the license condition required the unilateral disaffirmance of a contract with a third party. Such a condition violated state law which prohibited unilateral disaffirmance. The Court held that while the federal government has preemptive capability in the area of interstate commerce, it had no such privilege in the area of state contract law. Hence, state contract law was supreme.
- 386 See e.g., City of Burbank v. Lockheed Air Terminal Inc., 411 U.S. 624 (1973).
- 387 E.g., Brotherhood of Railroad Trainmen v. Jacksonville Terminal Co., 394 U.S. 369 (1969).
- 388 E.g., Campbell v. Hussey, 368 U.S. 297, 301 (1961) (" . . . [W]e do not have the question of whether [state] law conflicts with federal law. Rather we have the question of pre-emption. . . [H]ere complementary state regulation is as fatal as state regulation which conflicts with the federal scheme.") Cf. Florida Lime and Avocado Growers Inc. v. Paul, 373 U.S. 132 (1963) finding pre-emption inappropriate as federal law was concerned with a minimum standard rather than a uniform standard.
- 389 See Gibbons v. Ogden 22 U.S. (9 Wheat) 1 (1824).
- 390 PURPA, § 210 (a)(2) and (f).
- 391 16 U.S.C. 824 (a)(b).
- 392 Chapter 411 N.H. Laws (1979) (to be codified N.H. Rev. Stat. Ann. § 362-A:3).
- 393 16 U.S.C. § 824(i).
- 394 44 Fed. Reg. 61203 (1979) (Proposed rule to be codified 18 C.F.R. § 292.104(a)).

- 395 44 Fed. Reg. 61193 (1979).
- 396 PURPA, § 210 (d).
- 397 FERC Staff Paper, 44 Fed. Reg. at 38,867 (1979).
- 398 Joint Explanatory Statement of the Committee Conference, U.S.
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- 399 Supra n. 371 at 10-11.

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